This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

WIDENER LIBRARY
HX HST2 /

ELEVENTH

VERMONT AGRICULTURAL REPORT

BY THE

STATE BOARD OF AGRICULTURE,

FOR THE

YEARS 1889-90.

W. W. COOKE,

SECRETARY OF THE BOARD.

MONTPELIER, VT.:
ARGUS AND PATIOT BOOK / ND JOB PRINTING HOUSE.
1890.

Sci 1644.2

Harvard College Library

FROM

the State Library

27 July, 1891.

ELEVENTH

VERMONT AGRICULTURAL REPORT

BY THE

STATE BOARD OF AGRICULTURE,

FOR THE

YEARS 1889-90.

W. W. COOKE,

SECRETARY OF THE BOARD.

MONTPELIER:
ARGUS AND PATRIOT PRINT,
1890.

~~512.20~~
Sci 1644.2

HARVARD COLLEGE
JUL 27 1891
LIBRARY

Vermont State Library

TABLE OF CONTENTS.

BOARD AND FERTILIZER LAWS.
REPORT OF THE SECRETARY OF THE BOARD.
AGRICULTURAL INSTITUTES.
DISCUSSIONS AT SAME.
ADDRESSES BY INVITED PARTIES.
ADDRESSES BY MEMBERS OF THE BOARD.

MEMBERS

OF THE

STATE BOARD OF AGRICULTURE.

1889-90.

HIS EXCELLENCY, WILLIAM P. DILLINGHAM, Waterbury, *Chairman.*

MATTHEW H. BUCKHAM, Pres. State Agricultural College, Burlington.

W. W. COOKE, Burlington, *Secretary of Board.*

M. W. DAVIS, Westminister, (P. O. Address, Bellows Falls).

R. C. SMITH, Pittsford, (P. O. Address, Florence).

H. W. VAIL, Pomfret.

WILLIAM CHAPIN, Middlesex.

C. M. WINSLOW, Brandon.

FORMER MEMBERS

OF THE

STATE BOARD OF AGRICULTURE.

1871-72.

His Excellency, JOHN W. STEWART.
JAMES B. ANGELL, President State Agricultural College.
PETER COLLIER, Secretary of the Board.

A. B. HALBERT, Essex.
CHARLES H. HEATH, Plainfield.
FREDERICK HOLBROOK, Brattleboro.
PITT W. HYDE, Castleton.
Z. E. JAMESON, Irasburgh.
NOAH B. SAFFORD, W. R. Junction.

1873-74.

His Excellency, JULIUS CONVERSE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
PETER COLLIER, Secretary of the Board.

A. B. HALBERT, Essex.
CHARLES H. HEATH, Montpelier.
FRANCIS D. DOUGLAS, Whiting.
PITT W. HYDE, Castleton.
Z. E. JAMESON, Irasburgh.
THOS. H. HOSKINS, Newport.

1875-76.

His Excellency, ASAHEL PECK.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
PETER COLLIER, Secretary of the Board.

THOMAS L. SHELDON, Rupert.
ALEXIS T. SMITH, New Haven.
JOHN B. MEAD, Randolph.
C. HORACE HUBBARD, Springfield.
GARDNER S. FASSETT, Enosburgh.
CYRUS G. PRINDLE, Charlotte.
JOHN H. MEAD, West Rutland.

1877-78.

His Excellency, HORACE FAIRBANKS.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
HENRY M. SEELY, Secretary of the Board.

GARDNER S. FASSETT, Enosburgh.
PETER COLLIER, Burlington.
ALBERT CHAPMAN, Middlebury.
JOHN H. MEAD, West Rutland.
ORA PAUL, Pomfret.
HENRY CHASE, Lyndon.

1879-80.

Under change of law, JOHN B. MEAD, of Randolph, was "Superintendent of Agricultural Affairs."

1881-82.

His Excellency, ROSWELL FARNHAM.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
HIRAM A. CUTTING, Secretary of the Board.

HENRY LANE, Cornwall.
E. M. GOODWIN, Hartland.
M. W. DAVIS, Westminster.
H. F. LOTHROP, Pittsford.
GARDNER S. FASSETT, Enosburgh.
E. R. TOWLE, Franklin.
E. R. PEMBER, Wells.

1883-84.

His Excellency, JOHN L. BARSTOW.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
HIRAM A. CUTTING, Secretary of the Board.

HENRY LANE, Cornwall.
E. M. GOODWIN, Hartland.
E. R. PEMBER, Wells.
E. R. TOWLE, Franklin.
M. W. DAVIS, Westminster.

1885-86.

His Excellency, SAMUEL E. PINGREE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
HIRAM A. CUTTING, Secretary of the Board.

HENRY LANE, Cornwall.
M. W. DAVIS, Westminster.
E. R. TOWLE, Franklin.
F. D. DOUGLAS, Whiting.
A. E. PERKINS, Pomfret.

1887-88.

His Excellency, EBENEZER J. ORMSBEE.
MATTHEW H. BUCKHAM, Pres. State Agricultural College.
W. W. COOKE, Secretary of the Board.

HENRY LANE, Cornwall.
M. W. DAVIS, Westminster.
D. L. CUSHING, Quechee.
H. H. HILL, Isle LaMotte.
R. C. SMITH, Pittsford.
H. W. VAIL, Pomfret.
WILLIAM CHAPIN, Middlesex.

AN ACT ESTABLISHING THE VERMONT BOARD OF AGRICULTURE.

It is hereby enacted by the General Assembly of the State of Vermont:

SEC. 1. The Governor of the State, the President of the University of Vermont and State Agricultural College, and six other persons appointed by the Governor and confirmed by the Senate, who shall hold their offices until the first day of December in that year in which the regular biennial session of the General Assembly occurs next after their appointment, shall constitute the Vermont Board of Agriculture, for the improvement of agriculture and the general interests of husbandry, and the promotion of agricultural education throughout the State. In case of vacancy in the Board by reason of death, resignation, or removal from the State of any member, or from any other cause, the Governor shall fill the vacancy by appointment as in other cases.

SEC. 2. The members of the Board shall receive two dollars per day each and their expenses necessarily incurred in the discharge of duties. They shall designate one of their number who shall serve as Secretary, and the entire expense of the Board shall not exceed twenty-five hundred dollars annually.

SEC. 3. The Board shall hold one meeting in each county in this State annually, and may hold as many more as it shall deem expedient, either independently or in connection with any society, association or other organization devoted to the same general object, and may, in its discretion, employ lecturers, essayists, or other aids in the conducting of its affairs, and shall, as far as may be practicable, aid and encourage State and local associations and societies.

SEC. 4. The Secretary shall prepare on or before the thirty-first of July of that year in which the regular biennial session of the General Assembly is held, a detailed report of the proceedings of the Board, with such suggestions and recommendations as the interests of agriculture may require, and may append thereto such abstracts of the proceedings of the several agricultural societies, dairymen's associations and farmers' clubs in the State as the Board shall deem advisable. The report shall be printed in such manner as the Board shall direct and such number as they shall deem advisable, five hundred copies of which shall be for the use of the State Librarian and General Assembly, and the remainder shall be distributed under the direction of the Board. The expense of printing the report shall be included in the appropriation made in section two of this act.

SEC. 5. An act entitled "An act establishing a State Superintendent of Agricultural Affairs," approved November 26, 1878, is hereby repealed.

SEC. 6. This act shall take effect from its passage.

Approved December 23, 1880.

No. 170.—JOINT RESOLUTION RELATING TO THE DUTIES OF THE BOARD OF AGRICULTURE.

It is hereby resolved by the Senate and House of Representatives:

That the Board of Agriculture are hereby directed to make the subject of forestry, including the planting of forest trees on the worn out or waste and rocky lands in this State, and the improvement and protection of all forests, one of the topics of instruction in their meetings among the people of Vermont, and that the discussions as to the best methods and measures to promote these objects shall be had, in view of the condition of affairs in each section of the State, as they meet there.

E. J. ORMSBEE,
President of the Senate.

JAMES K. BATCHELDER,
Speaker of the House of Representatives.

No. 99—AN ACT RELATING TO THE STATE BOARD OF AGRICULTURE.

It is hereby enacted by the General Assembly of the State of Vermont:

SEC. 1. Section one hundred and seventy-seven (177) of chapter sixteen (16) of the Revised Laws, is hereby amended by striking out the word "two" in the first line and inserting in lieu thereof the word "three."

SEC. 2. Section one hundred and seventy-nine (179) of the above mentioned chapter and Revised Laws, is hereby amended by striking out all of said section after the word "advisable" in the eighth line, and inserting in lieu thereof the following:

Four thousand copies of said report shall be printed, and the same shall be State printing to be contracted for under the provisions of act number 160 of the acts of 1884, and paid for like other State printing. Five hundred copies of said report shall be for the use of the General Assembly and the State Librarian, and the remainder shall be distributed to the people of the State under the direction of the Board of Agriculture.

SEC. 3. This act shall take effect from its passage.

Approved November 27, 1888.

FERTILIZER LAW.

It is hereby enacted by the General Assembly of the State of Vermont:

SEC. 1. Every lot or parcel of commercial fertilizers, or material used for manurial purposes, sold, offered or exposed for sale in the State of Vermont, the retail price of which is ten dollars or more per ton, shall be accompanied by a plainly printed statement clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand or trade-mark under which the fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water, and of phosphoric acid in available form soluble in distilled water, and reverted, as well as the total phosphoric acid. In case of those fertilizers which consist of other and cheaper materials, said labels shall give a correct general statement of the composition and ingredients it accompanies.

SEC. 2. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, offered or exposed for sale, the importer, manufacturer or party who causes it to be sold, or offers it for sale within the State of Vermont, shall file with the Director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act, and shall also deposit with said Director, at his request, a sealed jar, glass or bottle containing not less than one pound of the fertilizers, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 3. The manufacturer, importer or agent of any commercial fertilizer or material used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the State Treasurer, countersigned by the Director of the Vermont Agricultural Experiment Station, authorizing the sale of the same in the State, and shall securely affix to each barrel, bag or other package of fertilizer the word "Licensed," with the number and date of the license. The manufacturer or importer obtaining such license shall pay to the State one hundred dollars for such license, and the license shall expire on the thirty-first day of December of the year for which it is issued. One license shall cover all brands manufactured by any one manufacturer, corporation or company.

SEC. 4. Manufacturers and importers of commercial fertilizers sold or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizers are sold, offered or exposed for sale, file with the State Treasurer a bond, with sureties residing within the State, satisfactory to said Treasurer, in the sum

of one thousand dollars, payable to the State and conditioned for the payment of forfeitures and costs imposed on such manufacturers and importers for violating the provisions of this act, and such bond shall be renewed from time to time, as the State Treasurer may require.

SEC. 5. The term "commercial fertilizer," as used in this act, shall be taken to mean compounds and manufactured substances containing or represented as containing, two or more ingredients mentioned in section one of this act, but shall not apply to the separate ingredients used to manufacture the same, or to bone-meal, land plaster, lime or any substance the product of nature which has not been compounded.

SEC. 6. No person shall sell, offer or expose for sale, in the State of Vermont, any pulverized leather, raw, steamed, roasted or in any form as a fertilizer, or as an ingredient of any fertilizer or manure, without an explicit printed certificate of the fact, said certificate to be conspicuously affixed to every package of such fertilizer or manure, and to accompany or to go with every parcel or lot of the same.

SEC. 7. Any person selling, offering or exposing for sale, any commercial fertilizer, without the statement required by section one of this act, or with a label stating that said fertilizer contains a larger percentage of any one or more of the constituents mentioned in said section than is contained therein, or respecting the sale of which all of the provisions of the foregoing sections have not been fully complied with, shall forfeit fifty dollars for the first offence and one hundred dollars for each subsequent offence. This section shall not effect parties manufacturing, importing or purchasing fertilizers for their own use and not for sale in this State.

SEC. 8. All manufacturers and importers of commercial fertilizers, or wholesale dealers in the same, shall, not later than February first, furnish the Director of the Vermont Agricultural Experiment Station with a complete list of the brands and of agents selling, offering or exposing for sale, such fertilizers, and on the first of each succeeding month till May first such additional agents or dealers as in the mean time have been appointed.

SEC. 9. The Director shall cause one analysis or more of each fertilizer or material used for manurial purposes to be made annually and the result published monthly. Said Director is hereby authorized, in person or by deputy, to take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for manurial purposes, which may be in the possession of any manufacturer, importer, agent or dealer; but said sample shall be drawn in the presence of said party or parties in interest, or their representatives, and shall be taken from a parcel or number of packages which shall not be less than five of the whole lot inspected, and shall be thoroughly mixed and then

divided into two equal samples and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer or material sampled, the name of the party from whose stock the sample was drawn and the time and place of drawing, and said label shall be signed by the Director or his deputy and by the parties or party in interest, or their representatives present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the Director and the other by the party whose stock was sampled. The Director of the Vermont Agricultural Experiment Station shall notify the State Treasurer of all violations of this act and the State Treasurer shall commence a suit, in the name of the State, on the bond required to be filed by such manufacturer or importer, and prosecute the same to final judgment. It shall be the duty of the Treasurer upon ascertaining any violations of this act, to forthwith notify the manufacturers and importers, in writing, and give them not less than thirty days thereafter, in which to comply with the requirements of this act. But there shall be no prosecution in relation to the quality of the fertilizer or fertilizing material, if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

SEC. 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell fertilizers made in other states.

SEC. 11. Number one hundred and nineteen of the acts of 1882, and number eighty-nine of the acts of 1884 are hereby repealed.

SEC. 12. This act shall take effect January 1st, 1889.

Approved November 27, 1888.

REPORT OF THE SECRETARY.

To the Chairman and Members of the Board of Agriculture of the State of Vermont:

The Secretary herewith submits the following report of the work of the Board for the years 1889-90. This has consisted largely of holding Institutes in the various counties as provided by law, and also in connection with the "Dairymen's Association," Farmers' Clubs and the State Grange. Most of the Institutes have been full two days' meetings, but in a few instances less time has been given. At these Institutes and elsewhere the addresses and discussions have been mostly connected with agriculture, and always possessed an agricultural interest.

By requirements of the law we were to hold two meetings in each county since our last report, and as many more as we could do with the limited fund under our control. Such other Institutes have been held where there was the most urgent demand for them, or where we thought they would do the most good.

The following meetings have been held during the two years:—

Waterbury.....December 11th and 12th, 1888.
Brookfield.....December 13th and 14th, "
East Fairfield.....December 18th and 19th, "
Johnson.....December 20th and 21st, "
Coventry.....January 2nd and 3rd, 1889.
St. Johnsbury.....January 4th and 5th, "
Norwich.....January 8th and 9th, "
Bloomfield.....January 10th and 11th, "
Milton.....January 15th and 16th, "
Berlin.....January 21st and 22nd, "
Enosburgh Falls.....January 22nd, "
Alburgh.....January 23rd and 24th, "
Pittsford.....January 29th and 30th, "
Benson.....January 31st and February 1st, "
Brattleboro.....February 7th and 8th, "
Middlebury.....February 12th and 13th, "
Dorset.....February 14th and 15th, "
Grand Isle.....October 2nd and 3rd, "
Hardwick.....December 3rd and 4th, "
Glover.....December 5th and 6th, "
Stowe.....December 17th and 18th, "
Plainfield.....December 19th and 20th, "
West Concord.....January 7th and 8th, 1890.
Bradford.....January 9th and 10th, "
Addison.....January 14th and 15th, "

Royalton	January 21st and 22nd,	1890.
Woodstock	January 23rd and 24th,	"
Franklin	January 28th and 29th,	"
Underhill	January 30th and 31st,	"
Brandon	February 4th and 5th,	"
Bennington	February 6th and 7th,	"
Randolph Center	February 11th and 12th,	"
Westminster	February 13th and 14th,	"
Dorset	February 18th,	"

The papers presented at these meetings and the discussions that followed them form the bulk of this report.

Owing to an increase of appropriation by the last Legislature, the Board has had more funds at its disposal for conducting the meetings. At the outset the question arose whether this increase of appropriation should be used to hold *more* meetings or *better* ones. It was decided to adopt the latter course and the results have justified the decision. During the past winter especially, the work of the Board has met with a better reception than ever before. The farmers came to these meetings with a more evident desire to learn and with minds open to conviction.

It has been especially gatifying to the Board in holding meetings a second time in the same vicinity, to find the attendance and the interest greater on the second visit.

There is no doubt that these meetings have done much good, and there is a wide field of usefulness for them in the future.

W. W. COOKE,

Secretary of the Board.

INSTITUTES.

Under this heading is gathered the reports of the several meetings, more especially of the discussions that have followed regular lectures. The lectures are given in full further on in this volume. These discussions have been arranged in topics for easy reference.

BREEDING DAIRY STOCK.

BERLIN INSTITUTE.

Mr. Winslow of the Board said that there is no business in the world equal to dairying, yet no business has been handled so ignorantly and shiftlessly. Too many farmers do not know their own stock, do not know which cows pay and which do not. Half the cows in the State do not pay for what they eat, to say nothing about the labor. About one-third run you in debt, one-third pay expenses and the rest have to make up the loss. It costs nearly as much to keep a poor cow as a good one. It is wise for a man to know his cows individually. He may have a cow that gives a very large amount of milk in June, and another that will not give half as much then, but would give more in the whole season. He should weigh the milk the year round. No man is smart enough to remember the amount, and it must be weighed and registered. The quality of milk should be tested also, and after both these tests, he will be surprised at the number of poor cows he is keeping. We do not run a dairy for the fun of it, but must know that we are getting a dividend.

In the case of new breeds being introduced, first know what you want and give the animals, as far as possible, the same condition as they had in their native country. Any cattle brought here and kept poorly will revert to a scrubs. New England should breed cattle that come from countries similar to ours.

The Jerseys and Ayrshires come from similar sections, and develop favorably in our sections. These animals have been bred for a number of generations for butter and cheese, and size has not been developed. These breeds have good digestion, are good feeders and have a great tendency to convert feed into milk.

Holsteins have been bred in much richer pastures than ours, and for New England are not so profitable cattle as either of the former breeds mentioned. For my own fancy I prefer the Ayrshire. They are a very hardy and a good milking race. The Jerseys are

the best butter cows. The butter is of fine color and texture. The Ayrshires stand second with the the Jerseys for butter, with little difference between the two. Ayrshires are very fine cheese cows, while Holsteins are the largest milkers. Ayrshires are also first-class market cows. Jerseys for the milk market do not meet with as ready sale, neither are they as hardy as the Ayrshire. In their native Scotland they are subjected to very harsh treatment, are turned to the pasture both summer and winter, but by better feeding and breeding here they become larger and better developed animals. At a trial of Ayrshire cows one made 19½ pounds of butter in a week. I have weighed my milk nine years, and my herd has averaged as follows:

1880	6031	1885	7025
1881	6136	1886	6238
1882	6672	1887	5782
1883	6168	1888	6356
1884	6814		

It takes 22 pounds of milk on an average to make a pound of butter. A cow that will give 6,000 pounds of milk will pay. Discard any cow that will not make a pound of butter from 25 pounds of milk. I would not advise the selling out of the whole herd. Breed your best cows to a thoroughbred male of dairy stock, and thus build up a herd. Every farmer should be a breeder of his own cows.

BROOKFIELD INSTITUTE.

Mr. Vail read a paper on the breeding and management of dairy stock. If a man has an extra cow, one that gives a large amount of milk, and wants to duplicate her, he selects for a stock animal one whose progenitors come as near to his cow as can be, and by so doing he can almost surely duplicate her. All thoroughbred animals are brought about in this way; trotting horses, Merino sheep, and others. If the breeding is done in any other way the stock will revert, and they must be kept breeding for the same characteristics, and the longer they are bred in that channel the more surely will offspring be what is sought after. There is a diversity of opinion among the best breeders on the subject of breeding in and in. The best producing cows are more or less inbred.

Where success follows in some cases there are bad effects in others. Too many things are connected in breeding that are not thoroughly established. Breeding animals from the same sire and different dams is not close breeding.

I do not think it a good plan to feed animals too highly that are intended for the dairy; feed liberally, but not for fat, and on the other hand, do not feed with too much stint by all means. I want my too-year-old heifers to be well developed when they come in, and weigh, say 700, if they are Jerseys.

Milk fever is a common disease when their feed is high. It never attacks a poor cow. Cressey says milk fever is a disease seated on the base of the brain. It might obviate the difficulty to

milk the animal a few days before she comes in, or to reduce the feed. I milk my cows ten months, take off the grain then if the cow is in good condition. I would milk less often, and take all of the grain from the cow if she was not inclined to dry off. A cow does not do so well to be milked the year round. We always bleed when a cow is attacked with milk fever. Garget is created by various causes—injury to the udder, inflammation, etc. If it is caused by inflammation use hot water; where it comes without that I do not try to doctor. It has a tendency to weaken the offspring to milk the cow the year round. I think the cow should be dry two months.

Moulton Brothers have a cow that dropped three calves in three years without missing milking, but I would not advise such a practice. I know of no way whereby ill-developed udders can be improved in heifers. We often find good cows with very poorly developed udders, that is too large in some proportion and small in others, but they are very unsalable, and I should not want to breed from such an animal.

ROYALTON INSTITUTE.

M. F. Preston, of Sharon, read a paper on Devon cattle. He said the first Devons brought into this country were presented by the Earl of Leicester to a Robert Patterson, of Maryland. Mr. Preston gave a very interesting history of this breed of cattle from the importation of the first lot to the present time. He said they were very hardy, easily kept, docile, made the best of oxen, and for beef animals were unsurpassed by any other breeds. They fatten very easily and make beef that is marbled and of first quality. New England is well adapted for the rearing of this breed; they are well adapted to our hill pastures; never heard of a case of abortion in a Devon herd; they have very strong characteristics and transmit them when crossed on other breeds; calves fatten easily; no trouble to make calves weigh 200 pounds when five weeks old. As milkers they are unsurpassed for quality; the skim-milk of the Devons is the richest of any breed; one calf raised on skim-milk at ten months old weighed 600 pounds.

Prof. Cooke stated that breeders of dairy stock should learn from the methods used by horsemen. The breeder of trotting stock is careful to get trotting blood on both sides. So our dairymen should select their best cows and should use only such bulls as are known to be from good milking stock for several generations back on both sides. The better the dairy the more care it will require to keep it up to the standard, and the harder it will be to improve. But we must improve if we are to make farming profitable. This better breeding cannot be assured by buying a pedigreed animal. Many an animal with a long pedigree would be expensive as a gift. The animal must have been bred and selected for at least five generations for whatever purpose it is wanted, and the animal itself must be good as well as its breeding.

The question was asked why it was that the value of feed as

determined by chemical analysis, did not always agree with the result obtained when that feed was given to the cow. Prof. Cooke replied, that in his opinion the liking of the animal for the food was an important factor in the results she would give at the milk pail from this food, and this was something that could not be told by chemical analysis.

STOWE INSTITUTE.

Prof. W. W. Cooke, of Burlington, was the first speaker, taking for his subject "Breeding Dairy Stock." During his talk, Prof. Cooke said: "To secure profitable results, the dairy cow that will make 300 pounds of butter per year must receive the best of care, as she is in a highly nervous condition. On the other hand a cow that produced but 100 pounds of butter annually will stand a coniderable amount of exposure without injury. A farmer should have an ideal of the cow he desires, and breed for that ideal. The highly bred Jersey and Holstein have each strong natures, and a cross-breeding will not always produce the good points of both.

Mr. Gale: "I should expect such a cross would produce some very fine cows and some of the other sort."

Prof. Cooke: "That is so. The most highly bred animals will beget scrubs; indeed, the tendency to do so is greater than among mongrels, because they are farther removed from the original grade. Go anywhere before a community of farmers and advise them to use a thoroughbred bull and they will tell you that their grade bulls produce better stock. The reason for this is, that they buy pedigree and not a thoroughbred animal. No one can expect to get a thoroughbred for a small amount of money. A bull should have all the external marks of the fine bred cow."

Mr. Wilkins: "Suppose a bull has all these external marks and a good pedigree, would it be a safe investment?"

Prof. Cook: "I think it would. I should prefer a scrub bull and good pedigree to a good bull and scrub pedigree, because I think the ancestry of the first would have a stronger influence, and better stock would be the result."

Mr. McMahon: "What breed of cows is profitable to keep?"

Prof. Cooke: "That is a difficult question to answer. You might take 100 of the best dairies in the State and find the preponderance of breed, but very likely one would be better for milk and another for butter."

C. M. Winslow, of Brandon, said: "The cow is merely a machine, while a horse must have disposition and pluck, as well as external marks, to become a trotter."

Mr. Wilkins: "Even if a thoroughbred animal had all these characteristics, would it not be possible for him to be a failure?"

Mr. Winslow: "It would be possible, but not probable."

WOODSTOCK INSTITUTE.

George Aitken read his paper on Stock Breeding, which is given in full elsewhere. At its close he was questioned freely

regarding his method of feeding the Billings herd. He feeds his cows three times a day with early upland hay and corn-stalks, cut and mixed and steamed, six pounds of a mixture of ground oats, cob meal, bran and barley, and a half bushel, or thirty pounds, of mangolds. Does not feed cotton-seed meal. Once tried it when making butter for the New York market, and his customers complained of the flavor. Cows in full milk may take a bushel of roots. Turnips cannot be fed. He mixes two bushels of roots with the fodder before steaming to give it a flavor. There is no advantage in steaming hay, but a decided advantage in cutting it. Never give cows cold water. As to ensilage, he is a temperance man, and does not believe in feeding the cows liquor that he won't take himself. Ensilage endangers the constitution of the animal. In breeding in-and-in better results are obtained from converging lines of the same family. The deterioration of sheep in Vermont is due to the fact that they have been bred for one purpose, wool. In this way the defects have been bred and intensified.

Mr. Smith, of the Board, followed on winter dairying, and strongly urged dairymen to turn their business about and give the cows their rest in June, July and August, when it is worth far more to them in the pasture than in the barn in midwinter. This is also the busiest season for the farmer, when he has the least time that he wants to spend in milking. Speaking of the low average of milk, he said the farmers generally breed just as they bought, without any idea of improvement, and do not know their own cows. They may be able to tell which will give the most milk, and how many months she will stay in milk, but as to which is really the best cow, all things considered, they cannot say. Keep the cows warm. A shivering cow cannot give milk. Have the best hay at the top of the mow to feed first. Feed the poor hay in midwinter. His own cows he feeds hay in the morning, then turns them out to drink, and then gives a little grain and corn-stalks. This is the first feeding. Then at four o'clock feeds and waters again. If a large amount of grain is fed, divide it between the two feeds. In rearing calves give milk till four months old.

BUTTER-MAKING.

BENNINGTON INSTITUTE.

Prof. W. W. Cooke, of Burlington was the next speaker, Subject: "Handling of milk."

Probably three-fourths of the milk in this section is set in shallow pans. Milk at this season of the year is heavy and needs to be reduced with water warmed to a temperature of 110 degrees; one-fourth the amount of water. This manner of warming milk has a most excellent result. The usual practice is to let the milk set 36 hours, but this is wrong, for milk treated in this manner will

raise the cream in less than 24 hours. The separation is more perfect than when set just as it comes from the cow. Very likely all the skim milk taken off in this vicinity would have as much as one per cent. of butter fats left in it. Some think that the fats in the imperfectly skimmed milk are of no value, but this a great mistake. At the Experiment farm we made some butter from skim milk by recovering the fat with the separator, and it scored over eighty-five points at the dairy exhibit at Rutland. If you put milk watered as above into a glass, the same depth as you set in pans, you will most likely find a perfect separation in about three hours. Skim at least as soon as the milk is 24 hours old. Cream when set for ripening, should be sweet. In ripening, mix and heat to 70 or 75 degrees, with hot water in a tub placing the cream can in it. Cream will stand 130 degrees heat in the tub and not injure the cream or the butter, but does not need a heat above 75 degrees. Before churning reduce the cream with water so it will take 4 pounds of cream to make a pound of butter.

Dairying, as now carried on, is not woman's work. Any and all the different systems can be made to produce a first-class article of butter, and they can also produce a very poor article. More depends upon the man than any peculiar system. Cleanliness is of the utmost importance. The cream gatherer has the chance to know whether the stables and dairy house are kept as they should be. We have got to have good cows for making good butter; cows that will give a healthy article of milk. To make a first-class article of butter we must have a first-class feed, but more will depend upon the man who handles the milk than anything else.

The taste of the consumer of butter has changed much in the past few years. Consumers now want butter that has no taste of buttermilk. Demand for butter made from sweet cream increases. Best butter-makers sour cream but slightly. I think that within ten years we shall not only skim milk sweet but shall churn the sweet. The acid in cream is carried away in a great measure by washing the butter. Sweet cream butter will not keep long. A creamery should run every month in the year to hold its patrons and be successful. It is more difficult to churn sweet cream and get all the butter fats than sour. Cream should be mixed at least 12 hours before churning, and churned at 55 to 59 degrees to obtain the best results.

BENSON INSTITUTE.

Prof. W. W. Cooke was the first speaker, who expressed himself pleased to see so many ladies present also to notice the effort to improve the condition of our State; the improvement must begin at home, for it is here that we practice the problems of every day life. Mr. Cooke then spoke of the influence of feed on milk. This is a very important question for the farmers to consider. The constituent parts of milk are water, fat, casein and sugar and ash, or in other words a certain amount of salts in solution in water. With ordinary milk in the month of May it

will take from 25 to 27 pounds to make a pound of butter. Milk of this kind will analyze as follows: 3.5 per cent. fat. 3.5 casein and four per cent. of sugar with the mineral matter, ash, etc. Milk is a perfect food for young animals, it produces both flesh and bone. The total solids of milk at this season are 11 per cent., water 89 per cent. This milk would be below the standard in Vermont and Massachusetts. There are changes in the character of milk irrespective of condition from the time the calf is dropped till the cow goes dry. There will be a constant decrease of water and increase of solids. For instance in August the milk will contain four per cent. of fat, five per cent. of ash and sugar and four per cent. of casein or only 87 per cent. of water. This is not invariable, the individuality of the cow is to be considered. In October the cow gives much less milk and it is much richer as the fat has increased to five per cent. Sugar, ash and casein will not increase to any great extent, 86 per cent. of water at this time. Jersey cows have given milk as high in fat as 7.5 per cent. but the other elements do not increase in like proportion, about 4.5 of casein and no more sugar, only 83 per cent. of water. It would take an expert to make cheese from such milk as this and not lose any of the fat. In poorer milk the casein holds all the fat but in very rich milk the amount of casein cannot carry all of the fats readily. Skim milk from the separator contains one-fourth of one per cent. of fat and 5.5 per cent. of casein 4.5 per cent. of sugar, ash, etc.

Can we feed so as to increase the fat in milk? It has been tested and only palm nut oil would produce the desired effect in a measure, but other substances will not, unless by a long and continuous feeding of many years. We have changed the character of the milk when we have changed the relative proportions of the solids, but not the water, that will remain the same.

Mr. Sheldon, of Fairhaven said he could change the value of his milk by feeding cotton seed meal. It would raise more cream.

Prof. Cooke.—You can feed so as to improve the creaming of the milk and get more butter, but by getting less waste in buttermilk. Vegetables containing sulphur oils fed to cows will taint the milk through the system of the cow but the milk can be tainted through the air by such substances. I will agree with the man who says he can increase the spaces of the cream.

One man who had been feeding cotton seed meal changed to corn meal and got a shortage of cream and butter. The speaker said much of the fats were wasted in the buttermilk or left in the skim milk. Bran has been thought to change the churning of butter, but no change in amount of fat in milk by feeding corn meal but might in the amount of butter in the churn. First green grass that grows is very stimulating to milking, animals get an increase of fats, there also the per cent. of water increases. You can not make so decided a change from grass to hay but can change the character of the animal by long continuous feeding and breeding. Many animals cannot be fed to change their character.

Jersey cows are very variable. The offspring can be worked either to quality or quantity. Buttermilk from the average creamery contains about one-half of one per cent. of butter.

Mr. Sheldon—In my creamery I churn Jersey milk with the rest at 55 degrees. But when taken alone it has to be warmed to nearly 70. Is there a loss in that cream when churned together?

Prof. Cooke—I think not. The cream from the separator so mixes it that in ripening it is so thoroughly mixed that all churns together.

BROOKFIELD INSTITUTE.

I think white specks in butter are caused by dried cream.

Mr. Smith.—They are not found in butter made by the centrifugal process or deep setting and I conclude they are caused by the air drying in shallow setting.

Mr. Vail.—I think there may be some butter in these, but the larger part is composed of curd. It was agreed that one of the dairymen should send a sample of the white specks to Prof. Cooke. Butter can be made so that there are curd and other matter detrimentally worked in; streaked butter is the result of uneven salting. I churn and wash in as small grain as possible, then put on a worker to drain, I salt ¾ of an ounce of Higgins to a pound of butter.

Mr. Colt said he churned his cream sweet and thought he could make good butter, but he would just as soon have it a little acid.

Mr. Vail.—There is much danger in having the cream over soured. I milk from 16 to 20 cows and have never been able to get 300 pounds to the cow on an average, I have too many heifers and old cows, kept more particularly for breeding purposes. My cows come in both spring and fall. I am feeding all cut feed, cows will eat more than they should, and if too much is eaten it is not perfectly digested and not only does no good but is an injury to the animal.

I feed 15 pounds of cut stalks and hay, 4 pounds of bran and corn meal mixed, two to one in weight, and three pounds of cotton seed meal.

FRANKLIN INSTITUTE.

Understanding, said Prof. Cooke, that a large part of the milk made into butter on the farms in this county was set in open pans, he first spoke in relation to this method. When using the small pans would advise putting with the milk on straining, about one-fourth of hot water in addition. Would keep the temperature at about 60 to 65 degrees in the milk-room. Skim at 36 hours and keep cream at 50 degrees. Would churn at least twice a week. The cream would be nearly sweet. After adding last skimming, stir, then warm up to 70 degrees, after which let it stand at 60 degrees until slightly sour. Would add to the cream an equal amount of water to thin it and assist in getting rid of the casein or cheesy matter, which is not desirable in the butter. Do not

allow cream to freeze before churning, as this is not always safe. Would thin cream for churning so that it will require four pounds to make one of butter. This will facilitate the separation of the butter from the buttermilk.

Dairymen should have a proper thermometer and be sure that the temperature is right and not guess at it. This will vary at different seasons of the year and under different conditions as to feed, etc. The temperature will vary from 58 to 65 degrees, the first in warm weather and the last when it is cold. A temperature that will allow of the cream being brought to butter in one-half hour is about right. With a low temperature will require more time but the butter will be better and more of it, and the reverse when the cream is too warm. He thought that most of the best butter-makers wash it in the granular form which is a convincing argument that this is the best way.

Butter as now made will not keep so long and so well as it did five or ten years ago, but the demand is for the article as now made and which is wanted fresh for consumption. The taste has changed within this time and a peculiar flavor is wanted of pure butter fat, rather than of casein or buttermilk. Thought that in the future perfectly sweet cream butter will be in demand. This of course would not keep but a short time, but must be used while fresh. An even production of butter all through the year would be a real advantage to the producers.

He spoke at some length concerning deep setting of milk. When the conditions are right, practically all of the cream can be obtained, but unless much care is used more or less will be lost. Would advise adding 20 or 25 per cent. of warm water with the milk as an advantage in getting a more perfect separation of the cream. Next the temperature of the milk should be reduced quickly to below 45 degrees. After the cream is removed it should be kept cold and sweet until 24 hours before churning, when it should be warmed up to 70 or 75 degrees and then left a day to ripen at about 60 degrees. The cream should be thoroughly stirred while warming.

There is no necessity for adding water to the cream raised in this way, as it is already thin enough. He thought that sometimes the buttermilk would be about as rich in fat as new milk, owing to an imperfect separation. This is too much waste and it should be avoided if possible. With proper care the buttermilk should not be any richer than the skimmed milk. If there is any cream adhering to the churn when the butter begins to come, there will be no use in then mixing it with the rest, as it would most certainly go into the buttermilk.

Next he spoke of the separator system. The most important point here is having all of the milk delivered at the creamery in a good and clean condition. All of the patrons as well as the proprietors should be interested in this. He thought with proper care the milk might be brought to the creamery only once a day, in good condition. This would be a matter of much importance

to the patrons. Keep the night's milk as cool as possible and do not mix the night's and morning's milk together.

It begins to look now that the butter extractor would become the system of the future, but experience will determine this matter.

GRAND ISLE INSTITUTE.

Next Prof. Cooke took up the subject of making the cream into butter. He first spoke of the various methods of obtaining the cream from the milk. Was of the opinion that the new butter extractor, or something that will take its place, will ultimately come into use.

He thought that experience will prove that there is no practical difference in the quality of butter made from the deep setting and centrifugal methods. Under the best conditions does not think there is much difference in the amount of butter made. But it will be found difficult to have the conditions so perfect with shallow setting as to get as much butter as with either the deep-setting or separator methods, although the quality may be as good or better.

There is a difference between butter made from sweet and sour cream, in quantity and quality.

It is generally conceded that butter made from cream from milk set in the open air, possesses the best flavor. The Moulton Brothers, who produce excellent butter, obtain the cream by deep-setting, but after it is removed it is placed in large shallow pans and frequently stirred for about 24 hours.

Would use some kind of a revolving churn without any inside works; in principle it would not matter what kind. The temperature at which the cream should be churned will vary somewhat according to circumstances.

It is generally found that the cream from Jersey milk will need to be about five degrees higher when churned than from common cows. This can be determined by experiment. The lower the temperature the more butter will be obtained, but it will require more time to churn. The most butter should be obtained from cream at the stage when it becomes thick, but not wheyed, as at that point the quantity will begin to grow less. The market demand is growing in favor of butter made from cream just commencing to become acid.

The inquiry for butter made from sweet cream is at present quite small. The market now demands that there shall not be a buttermilk taste or flavor. This can only be prevented by stopping the churn when the butter is in granular form and washing out the buttermilk while it is in this condition, which can be much easier done than when the butter is allowed to be first gathered into a solid mass. This can only be controlled by the temperature. When the butter first commences to come if a little salt is put into the churn the separation will be accelerated.

Brine may be added instead of salt. A little more churning is necessary and then cold water should be poured in, reducing the

temperature to 55 degrees, when the butter-milk can be easily drawn off. Then pour in more cold water and wash clean. The last water should be warmer. The butter can then be worked and packed directly.

GLOVER INSTITUTE.

Prof. Cooke spoke about butter making, saying there are four things absolutely essential in successful dairying: first, good cows; second, good feed; third, perfect cleanliness; fourth, a good dairyman. A good butter cow, or one that makes good butter, is one that makes a high-flavored butter. The quality of the butter is in the four essential things, not in the system of making. There is a certain flavor in butter made from ripened cream that is not in butter made from sweet cream. Fresh butter made from sweet cream without salt is used in New York city, and recommended by some. Think about one-half hour is long enough to churn, but with our multitude of ways of raising cream, no definite rule of temperature can be laid down, but would not have a temperature so as to churn in less than half an hour. Mixing cream of different skimmings just before churning will not work well; should be mixed twenty-four hours before churning, or there will be loss.

PLAINFIELD INSTITUTE.

After Mr. Smith's paper on "The Dairy" he was questioned sharply on churning, etc. There was quite a difference in opinion among the farmers in regard to the exact time to stop the churn. Some favored when the granules were the size of wheat kernels, others when much larger, and some when churned to a solid mass. Mr. Smith said: I have never made any test to find whether there is any loss, but I prefer the granules as large as kernels of corn. It washes quicker, and does not run out of the churn with the buttermilk; wash with water as low as 55°, and the butter will not gather; salt in the churn.

A dairyman said: "The smaller the granules the cleaner it would wash; never found any cream on the buttermilk."

Mr. Currier, of Berlin, said: "I churn my butter into a solid mass, and wash it in that shape, find no milk in it when we work it, think it less waste and less work than to wash in granular form."

Mr. Pike, of Marshfield, said: "Have made several tests in churning, using the Blanchard and Stoddard churns. We divided as equally as we could cream from Cooley creamers, enough to make 40 pounds of butter; Blanchard churn was the quickest in doing the work, churning to a solid mass, the Stoddard churning to small granules. In this particular test the Blanchard was ahead 18 ounces in quantity of butter. Three other tests were made with similar results. Do not attribute the difference so much in the churn as the time of stopping."

Prof. Cooke said: "We churn in the Stoddard churn at the

Experiment Station, and only bring to granules the size of wheat kernels; know there is no loss, for we analyze the buttermilk and skim-milk."

POMFRET INSTITUTE.

After a duet by Edward and Angie Leonard, George Aitken spoke upon "The model butter cow." He said that the butter cow was the most valuable animal on our farms. We make a great mistake in looking upon the cow that makes the greatest quantity of butter in a given time as the model cow, without considering the feed, quality of the butter, or ability of the animal to make butter throughout the year. Cows differ greatly as to the taste and color of their butter. Artificial coloring of butter will, in the future, be prohibited by law, as it is as much a fraud as the adulteration of other articles of food, and we should breed for cows which will produce gilt-edge butter. The model butter cow must be able to transmit her qualities to her offspring. The crossing of the native breed with the thoroughbred Jersey is a vast improvement, but the better way is to purchase the thoroughbred, as they are at the present time within the means of all. He considered the Jerseys the best cows for butter. No finer flavored butter is manufactured than that of Vermont, and the future will see Vermont butter in nearly all the countries of the world. More cream will separate from the milk on grass feed than any other. The speaker used the Cooley creamer, and does not use artificial coloring matter, but feeds mangol-wurtzels, which gives the butter the proper color. The cost of raising these roots is about four cents per bushel.

O. M. Tinkham said that feed did change the quality and quantity of butter, and he thought that the dairymen and chemists who differ on this point did not understand the real position of each other.

Rev. Mr. Tillotson gave a short and eloquent tribute to the memory of George Washington, this being the 157th anniversary of his birth. The session closed with music.

At the evening session O. M. Tinkham spoke upon "What are the prime requisites for making good butter," giving his belief rather than facts. He said as good butter can be made from few as well as many cows. It was not necessary to use any particular kind of creamers or churns and, as 20 butter globules could rest on the point of a No. 8 cambric needle, he did not believe that floats in a churn would injure the butter globules. The hands are the best butter worker. Milk does not absorb odors from the stable until the milk is cooler than the surrounding atmosphere.

A cow in perfect health, on good feed, would not impart an odor to the milk which needed to be taken away. He believed the old-fashioned small pans to be as good as anything for setting milk. In washing and salting butter, suit your customers; if they wished it unwashed, let them have it so, and salt to their taste, but usually one ounce to the pound is sufficient. Any motion that

grinds or slides over butter is liable to injure it. To make good butter, 1st, have a butter cow, either a Jersey or Guernsey. 2d, feed well. June grass is the best for the finest flavored butter.

Good care is requisite, but it affects the quantity rather than the quality of butter. Clover hay, corn meal, and wheat bran are the most perfect winter feed. He did not like the cotton-seed meal for milch cows. We ought to feed more roots as a substitute for artificial coloring. He thought that the increased quantity and quality of Pomfret butter was due to the importation of the Jersey cow.

STOWE INSTITUTE.

Prof. Cooke: "I don't think the carrying of cream will injure it for making butter. The man who churns it, if he understands his business, will get all the butter from it. Milk set at 50° in Cooley cans will not raise all the cream. If some patrons in a co-operative creamery set milk at 48° and others at 45°, the one at 45° will get more for his milk. The lower the temperature the more spaces of cream. The time of separation of the cream from milk will depend upon the cow. While the milk of the Jerseys will separate in two hours, the milk of the Devons will require a much longer time. If you water your milk you will get a better and more perfect separation than otherwise. Can get more butter fat from the milk in the Cooley creameries when set at 44° than at a higher temperature.

WESTMINSTER INSTITUTE.

The hall was crowded in the evening, and Miss A. L. Fisher sang a song in opening, which gave general pleasure. Prof. W. W. Cooke, of the Experiment Station at Burlington, then spoke on "Butter Making" and with a desire to ascertain the method most popular among his audience, called for a standing vote. The result showed that there were 27 who used some form of shallow setting, to 16 who believed in other systems, and his remarks were made from this basis. His remarks were in the style of a familiar practical talk, and he was listened to with the closest attention: "I wish to give you what I consider the best form of shallow setting. Most of you use four or six-quart pans. To get the best results pour into your pans of milk one quart of hot water, say at 110°. Then strain the milk and let it stand. Never mind the warmth of the room. You will be surprised at the result, and you can observe the effect by trying the experiment in a glass jar. Skim the milk while sweet, and take the cream where it will keep cool until your churning is completed. A temperature of 55° is about right. Then mix thoroughly and let it warm to 70° or 75°, and let it stand to 60° or 65°, until sour. Dilute cream with water until four pounds of cream make one pound of butter. The plentiful use of water will cure all diseases of cream and help the churning, for it decreases the resistance to the cream's rising. The effect passes on, and is found in the cream when churning.

The first change from the old handling was 25 years ago when it was a radical one, and from a warm shallow setting, passed to a deep, cold one. It was scoffed at, but it worked. Later, force was used. This again was ridiculed, but has since proved a good way. Just now a new machine produces butter from milk, and again changes the handling of milk. I believe the extractor will work. All different systems work on same milk. Good milk is the first necessity. For this is necessary, good cows and good flavor, good feed, and for the highest grade of butter, especial care. Absolute cleanliness must be observed all the way through, for no factor has so much to do with results. The trouble is that we forget some detail. The milk pails are clean, but the cows are dirty, the hands, stables, milk-rooms, or something. You can't get the dirt out, and the best way is to keep it out at first. The man is back of all. Look round the market and you will find that all these systems make seccessful butter. The man is more than the system. It is man's work and not woman's. You have the cream. Shall you ripen it? If your customer wants it, by all means. There is a constant change in public taste, and the butter of our mothers is no good now. Butter from sour cream used to be the taste. Sweet cream is coming to be. The present taste is for slightly acid butter, and the public wants slightly sour but not thick cream. To reach the right stage have each pan of cream just ripe enough, and all pans alike. In a grain of butter there are from 8,000 to several million globules, and cream if not just right will divide and part be wasted in the buttermilk. Mix it thoroughly. Lots of farmers churn poorly. If your buttermilk is rich your churning is poor. Any kind of churn is good, so it treats all cream alike. It must not have any inside machinery or paddles. One pound of butter left in 200 pounds of buttermilk is good churning. You can mix cream if you mix thoroughly, and under proper ripening you can churn all cream alike. For temperature there is no set rule. Nobody can tell you about it. It varies according to the time of year, the kind of cows, and from countless other reasons. Churn at low temperature, for the higher the temperature the quicker will come the butter, the poorer will be its quality, and more difficulty you will find in its handling. Wash thoroughly in the granular form. Don't get the water too cold. Below 55° is low enough. Then wash again in water two or three degrees warmer. Salting is done in two ways, by brine and dry salt. The final points as to the quantity of salt and form can only be decided by your customers. Sell your butter as soon as made. What is the use of making quantities and keeping it." In closing he spoke of waste, and stated that 1,400,000 pounds of butter was needlessly wasted, simply because dairymen didn't know how to save it.

CORN FODDER AND ENSILAGE.

BENNINGTON INSTITUTE.

Mr. Vail said that we here are in the midst of a good corn growing section; also a place where a creamery is about to start, and corn is one of the most important feeds we can raise for the dairy.

We first heard of ensilage in Europe. It derived its name from France. This was the manner in which they pitted their roots and tops to preserve for winter use, and from this it was found that corn could be preserved as well. This was discovered by Goeffert. The first man to use it in this country was a Mr. Bailey of Massachusetts.

The first silo built in Vermont was by Capt. Morton, of Essex, and the first ensilage shown in public meeting was at a State Dairymen's meeting at St. Albans, where there were several sacks shown.

There was a general feeling of disgust by the farmers as they smelled or tasted it. The general impression was that the corn should come from the silo preserved in taste and color, but they were disappointed in both. The brown color and sour taste and smell were disgusting, and the general expression from the farmers present was that such stuff was not fit to feed a cow for making butter; either for the promotion of health or for a nice product.

I was induced to build a silo from the fact that my hay crop had been cut off two seasons by a drouth and grasshoppers, and I had been obliged to buy hay by the car load to keep my herd of thoroughbred Jerseys, which I did not care to dispose of.

I first planted Southern corn on an old pasture and fertilized with phosphate. I was pleased with that fodder and have kept on filling my silo every year for the past eight years. Have put in oats and peas, rye, rowen and other crops, but corn will always be the leading crop for the silo.

I would locate my silo where it will be most convenient to feed from. It can be filled by carriers or an elevated driveway. At first it was thought they must be built of stone, but wood has been found to be much cheaper and better to preserve the crop. Stone has a tendency to collect moisture on the outer edges, and thus spoil a part of the ensilage that comes in contact with it. If made of wood paint with gas tar.

The corn first used for the silo was that kind which would grow the largest stalk. Now it has been found that a kind of corn that will mature early is much better. Have put in corn that was ripe enough to shell. The fermentation which takes place makes the corn soft and digestible; it has less moisture at this stage. The greener the corn the more acid the ensilage will be.

Corn can be put into the silo whole, and by weighting heavily will preserve well. The question whether to fill with cut or uncut corn has not been decided. I was troubled by the ensilage settling away from the sides of the silo at first, but by filling the middle

the highest can remedy that. I formerly husked my corn, but now put in whole; think I get more for my corn that way than if I husked it, and I save the expense of husking, grinding and taking to mill, etc. Many are not weighting the cut ensilage at present and meet with little loss. Many feed as soon as they finish filling the silo.

Two years ago a freeze destroyed nearly the whole crop of corn in Vermont. It could not be dried and there was great loss; much rotted on the ground. I put my corn in the silo just after the great freeze and I think I saved the whole of it. That year gave a great impetus to the silo. Frost does not seem to hurt the ensilage if put in the silo immediately. The small space in which you can store the fodder recommends the silo for general use. Putting corn into the silo or drying under the best condition, does not make much difference in the feeding value of the same. Experiments have been made by cutting corn and drying under cover, and it then loses about as much as the silos. There is a great loss in the usual method of drying corn fodder.

In answer to a question Mr. Vail said: I use the Sanford corn. Some prefer Stowell's evergreen. All stock relishes ensilage. One important feature in favor of ensilage is that cattle relish it so well. There is nothing my cows will eat so greedily as ensilage; will even leave grain for it. Think one great advantage is the animal requires some kind of succulent food, and this takes the place of roots. Have had less inflammatory diseases in my herd since feeding on ensilage. Sheep and hogs are being wintered more and more every year on ensilage, and many breeders of horses are feeding it to colts. One large breeder of horses in Kentucky put in a silo and bought twenty cows to produce milk for his colts, found the colts would eat ensilage and do better on it than on milk. He even fed it to a limited extent to young horses that were being worked for speed. There are no bad effects in feeding butter cows; it does not affect the product. The butter that drew the first prizes at our butter exhibits was largely made from ensilage. Milk will be spoiled when set any length of time where the odor of ensilage reaches it, but if taken away before it cools it will not. Turnips, onions and other vegetables that have an oil odor will ruin the dairy product.

Mr. Root said, Moulton Bros. who made the first prize butter at the World's Fair fed on ensilage about 25 pounds per cow per day.

Mr. Vail said, ensilage will be used as a soiling crop. Our pastures are growing less. We have to contend against drouth and worn out pastures. Can soil with oats and peas, Hungarian, etc.

Answers to Questions:

Mr. Vail.—The large butts of corn will analyze as well as any part of the corn. Never saw any butts taken from the silo that the cow would not eat. Can get in as much corn in a silo whole as cut, but whole corn must be weighted heavily. So must oats and

peas, or any fodder that has a hollow stalk. Always feed from the top of the silo and not cut it down, as it injures from the cut sides. It is not necessary either to fill slow or fast; should prefer to put corn in nearly ripe. It will not make a perfect feed; should feed bran or cotton seed meal to balance the ration, but not corn meal.

Prof. Cooke.—Oats, barley and rye, have about the same feeding elements; cotton seed meal is better to feed with ensilage.

Mr. Harwood asked: What is the relative value of feed when well cured or put in silo?—his corn cut green, cows eat all the stalks?

Prof. Cooke.—The digestibility of ensilage is not improved by putting into the silo. The most easily digested part passes off by the heating process and the same element passes off in drying. There is a waste of starch and sugar in either process. If corn fodder was weighed green there would be found to be a waste in drying, in dry matter as well as water.

Mr. Hickox—There is much more profit to ensilage large stalks than to dry them; can not be easily cured.

Prof. Cooke—The husking, shelling, grinding and toll for corn for 56 pounds of meal will cost about 17 cents. That will buy at present 20 pounds of corn. Corn put in the silo at glazed point the cob is digestible, and there is a benefit to the hard stalks being siloed.

An experiment in feeding the butts of corn stalks against the tips at the Vermont Experiment Farm, was found to be in favor of the lower part of the stalk. The experiment was made on milch cows.

Apple pomace is as good as corn ensilage. In the 200 days of feeding in winter one ton of this feed could be fed profitably to each cow, feeding ten pounds per day per head. Taken fresh from the mill, press hard into silo or bin, will not heat much nor ferment. Do not think it hurts much to freeze. Would feed in connection with other feeds about as follows: 10 pounds apple pomace, 10 pounds hay, 6 pounds grain, and what ensilage the cow would eat.

Our silos were filled this year in alternate layers of cut and whole ensilage (corn). Whole fodder comes out in the best shape. No sour smell about. Any ensilage has some sour taste or acid in it. The corn we used was mostly King Philip; all had ears and some quite ripe. Where whole corn is put in silo it is the universal verdict that it comes out in a better condition than the cut. The riper the corn is the more starch and less sugar. Not much difference in cost of putting in, whether whole or cut. Takes twice as long to get whole corn out of silo as cut.

THE CORN CROP.

BENSON INSTITUTE.

Mr. Davis spoke on corn. During the war the idea was that we could buy our corn cheaper than we could raise it. With our inflated currency we could buy, but times have somewhat changed. Where the soil is adapted to corn it can be grown much cheaper than bought. Corn, in its original condition, every kernel was covered with a husk. It is a very flexible plant, adapts itself to the country in which it grows. Dent corn taken east will in a few years change to flint, and vice versa. Corn takes the least from the soil and most from the air of any crop you can grow and with very little fertilizer you can raise corn for a number of years.

Mr. Humphrey—I have raised corn on the same land for 40 years and have good results. The possibilities of the crop is 100 bushels to the acre. When the land will not produce one ton of hay per acre I plat it to corn. Stover has value. I have wintered a two-year-old steer on an acre of stover. I get better results from my dairy by feeding once a day on corn stover in preference to twice a day on hay. This coming season will be an unfortunate year for corn growers from the fact that so much of the seed was spoiled last year. Freezing before perfectly dry will destroy the germ. Corn with proper breeding can be made to produce an ear on every joint of the stalks. I want my corn cut just as soon as it begins to glaze, both the fodder and corn will be better.

Seed corn must be ripe. It is often injured by freezing. I do not pick in the field, but husk that for seed before it gets into the barn. You want a large kernel with a very little taper to the ear. Corn should not run up and down hill. I would rather the rows would run north and south but am not particular about it. The seed has much to do with a good crop, it should come out of the ground in five days.

Mr. Barber.—I feed a great deal of meal and never buy a pound. I want my seed corn to hang on the outside of the building.

BLOOMFIELD INSTITUTE.

Mr. Vail—I think where corn is wilted a little it makes good ensilage and handles much lighter. I cut my corn for the silo when it begins to glaze. I think the frost-bitten corn could have been saved last fall if it had been siloed. Frost does not injure corn much if siloed soon after. It is not necessary to fill a silo in a great hurry as it will not hurt to fill slowly.

Mr. Beach—Our corn was frosted so badly that the stalk would readily pull apart at the joint.

Prof. Cooke—On the experiment farm we get from 10 tons to 26 tons to the acre. We can get as good ensilage from large corn as small, as a general thing. Cows will eat the large butts from the silo as readily as any.

Mr. Combs—I want to know the advantages of the silo over feeding with ears in the winter.

Mr. Vail—I seldom find a year when we can dry and store it in that way, but some seasons it would be all right. Some farmers are raising fodder corn and putting in large stocks and letting it stand till feeding time. It will not hurt by this managing.

Mr. Chapin—I don't know about the silo, but I like to raise fodder corn. I think I have raised 35 tons to the acre. I put up in large stocks and feed when wanted. It will not hurt in the winter. I cut it after it ears well and feed it without cutting and get good results.

Prof. Cooke—When corn is cut before it is frosted, and well husbanded it keeps in excellent condition. It looks as if the nutriment was all there but this is a mistake? Analysis proves it otherwise. The drying has resulted in a wasting of material all the time till perfectly dry. The sugar in the stalk turns to acid and goes into the air; so with the starch. I cannot tell at present just how much loss there is in the frosted corn of this past year's growth. There is some loss in silo. The preserving process of the silo is a kind of decay. It is better not to put corn into the silo that has not at least 25 per cent. of dry matter. Corn should not be siloed till the lower leaves show signs of being ripe or dry.

Mr. Vail—The feed for cows costs me 15 cents per day and I had cows that were making 1½ pounds of butter per day. My experience with ensilage is that where the corn crop can be grown successfully it is of the utmost importance, used in any form. By putting it in the silo it makes a very cheap and valuable fodder and in a form in which it can be handled at any time. I formerly used a large kind of corn, but now use a small variety, cutting ears and all, I think by so doing I can get the same value of feed for half the cost that I could if I husked the corn. Cattle love it and I think it is healthy for them. I never had any trouble by injury to butter from cows fed in that way. Perhaps ensilage can be so fed as to injure the cow and product also, so with cotton seed meal and many other feeds. I feed 20 pounds of ensilage per day with other feeds. Some men feed almost exclusively on it, with grain.

Mr. Beach—I have put it in without cutting and did not weight it. I covered it with straw and trod down every day. I experienced no difficulty in getting it out of the silo as I cut it in the silo with a lightning hay cutter. I feed silage twice a day to cows with grain. I plant Sanford ensilage corn and some western corn; don't know which is the better. I filled my silo this year with frosted corn. Cows eat it readily.

Prof. Cooke—There is no difference in the waste whether cut or uncut.

Mr. Beach—I have seeen silos where there would be too much juice in the bottom of the silo.

BRANDON INSTITUTE.

Mr. Smith, of the Board, suggested the seeding of meadows to grass and the most economical time for doing the same. Spoke of the manner of the farmers in the White River valley sowing their grass seed in the corn fields at second time of hoeing, and advocating level culture of corn in any event.

Mr. Chapin, of the Board, said the natural tendency is to hill up the corn—unless it is kept perfectly level it would not be practicable thus to sow. In this section there was no trouble in seeding with any kind of grain if sowed thin enough; one and one-half bushels of oats per acre would be enough.

Mr. Sumner, of Brandon, said: Hilling up corn is out of theory but not out of practice; every implement is calculated to make a hill; corn well hilled up will not stand the drought nearly so well as perfectly level culture. Corn does not need the hill to support the stalk; it will stand the best, and recover quicker when no hill is made; too much hilling will destroy the corn if a drought follows. Never had sown grass seed with corn, but could see no reason why it would not be practicable. I have no faith in our new craze of abandoned farms. Think it would be hard to find any abandoned farms that were in any way productive. They had better be allowed to grow up to woods again than to try to make farms of them. Think the scheme a humbug.

Mr. Chapin said: I live in a town where there are some abandoned farms, and some of them can be made, with little expense, quite productive. It is not all a humbug. He had seen Swedes west of the Mississippi river, also in Florida, and in both places they were considered first-class inhabitants.

Mr. Winslow, of Pittsford gave his experience in level corn culture, and very much favored that kind of cultivation. Said it would stand more drought and wind.

Rev. Mr. Lovett, Brandon said: Planted corn on ridges and by hoeing made it level; there came up a spontaneous growth of red top, which cut a good crop of hay the next year.

Adjourned to afternoon.

BROOKFIELD INSTITUTE.

Prof. Cooke said: "The corn plant was the most important to the Vermont farmer, next to hay; hay first, corn next. More pounds of digestible matter can be raised on an acre planted to corn than any other crop, and is one of the safest foods for animals of any class, while it is easily raised. Root crops are too expensive for the average farmer. The same labor expended in raising roots, if applied to corn, would produce more feeding value. The silos built of stone and cement are not a success, as the moisture drawn from the sides and bottom usually destroys the ensilage for from six to eight inches from the well. He would use wood silo as near air and water tight as it could be made, by using matched lumber, with tarred building paper between. He

thought the average cost of such a one would be about $2.00 for each ton of storage capacity.

In reply to questions, Prof. Cooke said he preferred some kind of corn that matured early—some kind that would grow in 90 or 100 days.

Burrell & Whitman corn is too large for this section. The Sanford corn is mostly used at the Experiment Station. Large corns have 85. per cent. of water to 15 per cent. of dry matter.

We should not raise our common field corn for the silo. Corn is injured for the silo by frost, but not ruined. Cows eat it just as well. If all the corn in Vermont should have been siloed after our September frosts, the feeding value would have been mostly saved. The weight of 50 cubic feet of ensilage is one ton. The speaker would expect a larger loss on ripe corn than when put in green. New machines make corn raising much easier. Start with level culture and continue it. In cultivating have the machine as light as possible. We cultivate to keep moisture in the soil. The time of cutting should be looked after. Corn should not be cut until very nearly mature. It does not want any ripening for ensilage. About two-thirds of the value of the filled corn is in the ear; one-third in the fodder.

DORSET INSTITUTE.

Prof. W. W. Cooke, of Burlington spoke on "Ensilage and soiling crops." If Vermont wants to keep her boys on the farm she must make farming pay better. Young men go where they think they can make money easy and fast. If our boys can make farming pay, less of them will go West, but 150 pounds of butter per cow will pay for keeping, and leave a very small margin. It will cost very little more to keep a cow making 300 pounds, and the question now arises how can we feed the cow well at the least expense. Where the silo has been introduced as a feed for the winter dairy it has proven very satisfactory.

Cows shrink not so much on account of the animal condition as the insufficiency of feed.

FRANKLIN INSTITUTE.

The meeting was called to order by Judge Cleaveland, who introduced Mr. Vail, of Pomfret. He spoke upon the subject of "Corn Fodder and Ensilage." This was a familiar talk and proved to be of much interest to the farmers.

He gave a brief history of silos and ensilage, both in the old country and the United States. At first he was opposed to this method of preserving fodder green, and did not think it would be successful. But the destructive work of grasshoppers on his grass induced him to try raising corn for ensilage. He built a wooden silo in his barn. This was seven or eight years ago, and has filled it every year since, and now does not have to purchase fodder. Has ensilage, rye, clover, rowen and peas and oats. These are

good, but corn will continue to be the leading crop for this purpose. It is now conceded that wooden silos are cheaper and better than those built of stone. It is not found necessary to weight the ensilage as formerly. Covering the ensilage with tarred paper and that with straw or old hay was recommended.

Rowen should be weighted somewhat. Corn can be put in the silo whole if desired, but it is much more work in getting it out. For a small farmer it might be better to put in whole, and save the cost of machinery. With a large quantity it might be better to cut before putting in the silo. Requires about 50 cubic feet of space for one ton of ensilage. Frosted corn put in the silo at once will not be found to be injured. Corn should be partially wilted unless nearly mature before putting in the silo. Common field corn about fully matured will make excellent ensilage. Puts all his corn in this way.

Would plant in rows and hills about three feet apart each way. Would fill the silo either quick or slow, as circumstances might require. Either way would do. Gives about 20 pounds of ensilage to each cow a day in two feeds, and then gives hay and grain in addition. His cows like it exceedingly well, so well as to leave grain for it. It gives an increase in milk and butter. Most kinds of stock do well with a ration of ensilage. Finds that with this kind of feed his cows are more healthy than they used to be. Fed in too large a quantity might result in injury to the quality, but fed as it should be does not think there will be trouble with the butter. Feeds a bushel of cut hay wet to each cow. 10 pounds of ensilage and 3½ pounds of meal at the same time. This is fed twice a day to cows giving milk. The grain consists of 3 pounds of bran and two pounds each of cotton seed meal and gluten meal. Waters twice a day.

The farmers questioned Mr. Vail very freely, indicating their interest in the subject under discussion. Prof. Cooke thought that there was rather more loss from drying fodder corn than putting it in the silo. Is of the opinion that in the future ensilage will be fed in July and August when the grass begins to fail in the pastures. Mr. Vail stated that it costs him 16 cents a day for feed for each cow. His cows average each one pound of butter a day. Of course he gets a good price for his butter. Mr. Chapin made a plea for Sanford corn to feed green as long as possible, and that will be until about cold weather. Mr. Smith does not like the idea of leaving fodder corn in the field until winter, as the vermin will make sad work of the grain. If put in the silo this difficulty will be avoided. The time up to the hour of adjournment was fully occupied in an interesting and profitable discussion.

GLOVER INSTITUTE.

Mr. Vail, of the Board, discussed the silo and ensilage. He had not at first been inclined to use the silo, but was rather forced to use one. He built by using a bent in his barn and made at a comparatively small expense a silo, which has proved successful in the

storage of all sorts of silage crops. First broke up four acres of pasture, used 300 pounds of phosphate on an acre and obtained a large crop. Plants the Sanford sweet, sows in drills, not thick. In ordinary years much of the corn ears, and frequently it nearly all ripens; cuts before the frost, if he gets to it—thinks frost does not harm it seriously—draws it to his barn and cuts it by a machine ¾ inch to cut, fills into his bin, keeping the middle considerably higher than the sides, treads it down firmly and, if corn, cares little whether it is weighed or not. Also puts early cut oats, rye, rowen, almost anything into the silo. The latter crops need heavy weighting. Cattle, sheep, horses, store hogs—all kinds of stock, thrive on the silage. Unless his corn is well eared he uses some bran or grain with this fodder and a little hay. Cattle relish it better than any sort of feed. Never has known of any bad effect from its use. The cost of harvesting the corn is about one dollar a ton. Three tons of this fodder is as good as a ton of hay. Mr. Vail thinks almost every farmer would find the silo profitable.

HARDWICK INSTITUTE.

My silo is built, said Mr. Vail, in the barn, 16 feet deep by 11x12. I have used rye, oats, peas and corn. Think oats and peas make the best of any kind of ensilage, though, as a whole, corn is the most profitable crop to raise for that purpose. I prefer a silo built of wood to one of stone or cement. A silo should be built so as to make it convenient for feeding, as ensilage is very heavy to handle. In growing corn for the silo I formerly used the large southern variety, but now grow the Sanford or our common kinds. I want it in a fit condition for the table before it is cut, and if riper would do no harm. I husk no corn. Think I get better returns from my corn by putting it in the silo than by husking and grinding. Where corn is very green it should be wilted before putting into the silo. I have had very good success with putting frosted corn into the silo. I often put rowen on top of corn ensilage without cutting, taking care to have it well packed, and only a small portion on top will injure. There have been more silos built in this State this year than ever before. The experience of last year with frosted corn has proved to the minds of thinking farmers that it is wise to have some place to save the crop if frost happens to overtake it, as there is very little loss from frost if put into the silo soon after. Another advantage is the large amount of fodder you can get into the small space; also nearly all stock seems to relish it. Hogs, horses, and cattle all thrive upon it, and in some sections it is used largely as a feed for weanling colts. Ensilage alone is not a perfect feed; needs bran, cotton seed meal or some feed of this nature with it. No green crop should be put into the silo that the juice will express.

In answer to questions Mr. Vail said it is not necessary to weight ensilage as only a small quantity will be injured. I feed 20 pounds of it per cow per day.

Mr. Crandall said: Farmers in this section are skeptical on this subject. I consider it a necessity for winter dairying. Cows need some succulent feed, and ensilage is as cheap as anything.

Mr. Vail said: I feed my ensilage with cut feed moistened, and feed only twice a day. My grain ration is gluten, cotton seed and bran. Don't think gluten will take the place of cotton seed, neither is it as cheap.

Mr. Bronson said: I built a silo seven years ago, in barn, 20 feet deep and 18x14. First year filled with oats nearly ripe alternating with corn. Packed it very closely by putting a pair mules in the silo to tread it down, and weighted it heavily. My corn ensilage produced more milk than oats did, and the cows prefer oats. Found by cutting down and feeding one-half first the remaining half injured more or less.

ST. JOHNSBURY INSTITUTE.

J. G. Hovey was elected chairman and on taking the chair he said he was proud to be called upon to preside over the deliberations of such an intelligent and progressive body of farmers. He spoke of the services of the farmers in raising the butter product from 100 to over 300 pounds per cow and increasing the steers fitted for the shambles to a weight of 1,300 or 1,400 where a few years ago they only weighed 1,000 or less. Caledonia county has reason to be proud of a certain class of her farmers and we only wish that they were all of this progressive kind.

Mr. W. P. Stafford gave the address of welcome. He said his personal knowledge in agriculture was limited, but the view all outsiders took of this calling was very flattering. The farming community is the physical basis of our country. Young blood goes to the city from the farms without which there would be a constant degeneracy both physically, mentally and morally. The farmers are the best thinking men in the community. No riots ever occur among them. They may be slow to act but are always on the right side. The farmers are the most independent class of people in the country and all other classes are dependent on them.

At the evening session Mr. J. R. Kennerson, of Peacham read a paper on the corn crop and ensilage. As Mr. Kennerson is a practical farmer and a very successful dairyman he was listened to with much interest. Mr. Kennerson said in substance: It is the truth that when a farmer who makes two blades of grass grow where only one grew before he is a public benefactor, and if this is so what must we call the man who raises only one spear where formally two or more were grown? Both classes can be found in almost any town in Vermont. Farmers should feel a moral accountability to the coming generation. Too many are farming as if the world were coming to an end in a few years, and their duty was to skin off all the available products they could. He spoke very feelingly of the many deserted homesteads in the State, of the sad feeling which came over him and others who visited the paternal farm to find only the cellar hole partially filled as the

only mark of a civilized home, and the land once rich and productive, now only scanty sheep pasture. Many farmers must pursue a different course of farming. Here and there in the State we find farms that have doubled their producing capacity in 10 years and some of the owners say they can double it again in another decade.

The raising of corn is the surest and best way to increase our forage crops and raised in any form it is valuable and too little attention is paid to fodder corn. No crop can be raised on an acre of land that will produce so much feeding value. He would recommend running a smoothing harrow ever the land before the corn comes up and often afterward until too large for that practice; also the regular field corn. Every farmer should make an effort to produce as much as possible. More corn means more stock and more stock means more grass. We seldom put a hoe into the field. Corn should be cut before the frost. Our practice is to cut and lay down, bind in small bundles putting four into a stook. After it had stood three weeks we restook it into very large shocks, drawing the tops together with a rope which has a ring in one end, and tying firmly. More corn is hurt in the barn than out of doors.

Corn stover as a fodder is very valuable. I have fed my dairy exclusively on it and grain till the first of February with good results. In this manner we can in a few years double our number of cows and thus double our dairy products. The dairy is best adapted to enriching the soil of any farm stock. Grain bought and fed to cows pays for itself in milk and increases the value of the manure pile. Butter takes the least fertilizing element from the soil of any farm product. Too many cows are kept in the State that do not pay. We should weed them out and raise our own cows, keep only the best stock, feed the pastures close and supplement at the barn where the pasture fails. Grass is not fit for milk after it has become woody.

In closing, Mr. Kennerson said: I ask not for political honors, and give me neither poverty nor riches nor worldly honors, but let me leave my farm to the dear ones in such a shape that it may prove a blessing to them and reflect credit upon me.

STOWE INSTITUTE.

Mr. Vail said: Ensilage will make a good soiling feed to use in summer when pastures fail. Most farmers have to make some calculations to bridge over the dry time in summer. There is more or less warmth in the ensilage the year around. I get less heat when put in nearly ripe and I put in corn nearly hard enough to grind, and find it soft and pliable when fed out, and my cows always increase in the quantity and quality of the milk when fed on ensilage. Do not think there is any advantage gained by the heating it undergoes.

Prof. Cooke said: In the South sorghum produces better ensilage than corn, but could not be raised with profit here. There

will be more of the starch digestible in the corn first taken from the field than the same if ensilaged or dried. More or less of the starch is turned into fiber by drying. Dry corn fodder has 30 per cent. water. Hay kept over summer loses a portion of its digestible matter. The better cows relish their feed the more it is worth to them.

Mr. Vail, in answer to questions, said: Apple pomace is about the same value as corn ensilage. Corn will always take a lead in ensilage feed. When put into the silo we lose very little of its feeding value. I feed no corn meal with my ensilage, but feed bran and cotton seed meal. Think I can fill my silo for 50 cents per ton. Think ensilage a very healthy food, and cows like it. Have had no sickness in my herd since I fed it. Think all cattle winter better if they have some succulent feed. Think it a good feed for young horses. Have known of sheep being fed on it with good success. Whenever we have had butter exhibits in this State the premium butter is almost always made from the milk of cows fed on ensilage. The milk should never be allowed to cool down in the barn. Don't think it makes any difference when ensilage is fed to the cows; with roots it is different; some of them contain sulphur oil which will injure the butter; turnips and onions have an oil odor; turnips may be fed and not injure the product, but it is risky; milk should be strained as soon as milked and not be disturbed afterward.

WESTMINSTER INSTITUTE.

Homer W. Vail, of Pomfret then spoke on "Corn Fodder and Ensilage" putting his thoughts into the form of a familiar talk to his audience. He said that the French nature of the word indicated the source from whence the method came, and it was understood in its infancy as a process of roots and herbs preserving. More recently modern ensilage had been the discovery of one Gofert, and the process was first given publicity by a Bailey of Massachusetts. Many Vermonters went to watch its working and investigate its results there, but the first general verdict was not satisfactory. It was first tried with better success by Captain Morton, of Essex. I first tried the silo as a last resort after a season of bad drought during which I was obliged to buy a good deal of hay. Since the first year's trial I have filled it yearly, sometimes with oats and peas, sometimes with clover, but largely with corn. Corn is the proper material for ensilage. Locate your silo near and convenient to your stables. Build them of wood which is much cheaper than stone and preserves ensilage much better. He suggested the construction of a silo of double boards with tar paper between and a coat of tar or resin to preserve the wood. He spoke of the general complaints he had heard as to the settling of ensilage and said: It is bound to settle and the only precaution necessery is to have it settle evenly. Fill your silo crowning, leaving the heap higher in the middle than at the corners. As the ensilage settles the greater weight of the middle will level the heap

and if well laid the corners as well as the rest will be sweet and good. It is now thought best to put in ensilage whole instead of cutting it. The advantages in his opinion were various and positive. The cost was about the same as for feed in its natural state and much waste was avoided as well as the loss by frost. The silo occupied little space and stock were very fond of the ensilage. Another advantage, speaking with particular reference to the dairy, was in the health of the animals to which it was fed. He had noticed that there was always a gain in stock when the silo was opened. The effect on cream was good, cream rising more rapidly and its churnability being increased. There is here again less waste. Cows will eat the buts of ensilage and are even fond of them. These stalks are fully as nutritious as the tops of corn, which has been proved by experiment. But the greatest advantage claimed for ensilage was the preservation of the whole crop; the ear as well as the stalk. He estimated the cost of husking and carting corn at 17 cents per 56 pounds, all of which was saved, and believed that the silo was an economic as well as valuable adjunct to the farm from all points of consideration.

After Mr. Vail's paper on corn and ensilage the following questions were asked and answered:

Mr. Ward—How many tons of ensilage is equal to a ton of hay? Mr. Vail—About three tons of good ensilage is equal to a ton of hay.

Mr. Pierce of the asylum farm at Brattleboro—Would you advise putting corn stover into silo? Mr. Vail—Corn stover makes good ensilage; put in green as possible and weight heavily.

Mr. Pierce—Would you advise ensilaging hay? Mr. Vail—No. Clover rowen can be put into the silo.

Prof. Cooke—Would you ensilage corn if you could dry corn fodder as cheaply as you can hay? Mr. Vail—Yes. We need some succulent feed for cows.

Mr. Pierce—How many times a day would you feed ensilage? Mr. Vail—I am feeding twice a day. Ensilage is not a perfect feed, it is too much carbon. It makes a good feed for store hogs.

Mr. Chase—Which will produce the most milk, 100 pounds of hay or 100 pounds of ensilage? Mr. Vail—Hay.

Mr. E. T. Fenton—Would you prefer whole or cut corn for ensilage? Mr. Vail—That would depend upon the situation of the silo, and which way you could fill the cheapest. Whole ensilage comes out slower, but keeps full as well.

H. A. Willard—How much do you tread the ensilage? Mr. Vail—I only put one man in a silo, tread around the sides and corners; the middle will take care of itself. Rowen, oats and peas need to be heavily weighted.

B. S. Haden, of Putney—How much do you feed your cows per day? Mr. Vail—Seven pounds of grain, 10 pounds of hay and 20 pounds of ensilage. Mr. Chase—My cows do not digest whole corn; would they if it was siloed? Mr. Vail—Yes, it softens so there is no loss.

B. S. Hudding—What is the probable cost of the silo? Mr. Vail—One can be built very cheaply. Balloon frame will answer.

D. C. Wright—Have had four years' experience with silo; raised half large corn and half Sanford; cut the ears all into the silo. Keep 23 head of cattle, 62 sheep, three horses and five hogs on 25 acres of mowing and plow land. Have raised 16 tons of corn per acre. Feed my cows four quarts of corn, mealy linseed, bran, oats and middling; mow my meadows twice; cut about three tons per acre; keep one-third more stock than I did before I put in silo; have increased the fertility of my farm; lose less by the silo than by harvesting; get its best crop of corn second time planting; land must be rich and mellow; harrow crop with smoothing harrow.

Mr. Campbell, of Wesminster—Feed ensilage to both sheep and cattle with good results; bushel basket full to 20 sheep, when the ensilage hurts over Sunday when filling, dry from the middle and tread on outside.

D. C. Wright—Would have silo deep and narrow; in feeding keep the ensilage level.

Vail—When corn is put in whole can be cut down.

Mr. Peck—Will stock eat the butts of corn stalks? Prof. Cooke. —We filled our silos with alternate layers of cut and whole ensilage and when in moderate quantities they eat it all.

Mr. Chapin—Corn fodder is an excellent feed for cows. Would advise all farmers to raise it; worth the most in its green state, cut and stooked up will keep till into the winter; always plant it 3x3 feet and cultivate; once cultivating worth as much as a dressing of phosphate; no trouble about its moulding.

Vail—Moulton Bros. have been known to have cut 40 acres in the winter; when snow is deep it is hard to harvest.

E. J. Willard—Heard chemists have found an element detrimental to feed. Prof. Cooke said they have never found anything of the kind. The making of vinegar does not make it unhealthful; when it occurs in our own food it is not unhealthful; fed in proper quantities no injurious effect upon the product; can spoil by over-feeding same as you can by feeding clover; no one can tell whether the cows eat ensilage or not by the butter or milk.

Mr. Vail, of the Board, then spoke upon ensilage, which he was unable to do the evening before by reason of hoarseness. He spoke briefly, advocating the use of ensilage.

George Aitken followed in opposition, and read a letter from an eminent chemist, who had analyzed some of the article and pronounced strongly against it. The Connecticut Experiment Station had found that in a hundred pounds of the very best ensilage there is a quart of strong vinegar and a pint of rum. He does not believe in feeding cattle with such stuff, much preferring roots, which are in themselves a complete and perfect ration, something that cannot be said of any other feed. He has recently had correspondence regarding root culture with Sir John B. Laws, of England, the leading authority in the world on agricultural chem-

istry, and assured him that he can grow roots more successfully in Vermont than in England. The general belief of Englishmen is to the contrary, but he has tried it in both countries and also in Pennsylvania, New York and on Long Island.

CROPS.

BROOKFIELD INSTITUTE.

In the afternoon Mr. Chapin read a paper on crops which he classed in importance as follows: Wheat, corn, barley, oats, rye and buck wheat. There are more oats raised in Vermont than any other kind of grain, but barley is on the increase and it should command more attention than the farmers.

Mr. Burbank, of Bloomfield, said he raised a two-rowed variety and was fairly successful with it. He raised this year over 45 bushsls per acre. The seed was from Canada. He mowed it with a machine, raked with a horse and bundled as he would hay.

Mr. Davis, of the Board—I prefer to cut barley with a reaper and as green as it will possibly do, say while the kernel is in the dough; and handle it with wooden barley forks. I do not bind it but draw it in the gavil. I consider the straw of value as a fodder if cut green and properly husbanded. Barley is one of the best grains to seed after. Farmers should use all the machinery they can in doing work as it is much cheaper than hand labor. In raising corn get the variety best adapted to your soil and keep it. It has a wonderful capacity for adapting itself to different soils and conditions.

BRATTLEBORO INSTITUTE.

Hon. William Chapin, of Middlesex spoke about cultivated crops. To cultivate means to prepare the ground. It should be well plowed and Vermont was indebted to a Brattleboro man, viz: Ex-Gov. Holbrook for one of the best plows used in Vermont. Mr. Chapin prefers to plow in the fall and put on plenty of manure, and that in the winter when practicable. He spoke of our harrows and recommended their use, as they much better fit the land for a crop than did the old fashioned soil packers. Cultivators and horse hoes have largely taken the place of hand hoeing. Always use horse power whenever you can in preference to to man power. He strongly urged the early harvesting of all crops. The analysis of all grains show more albmuminoids in early than in late cut grains, and that is the most expensive of all human foods. This rule applies to all grains whether for family consumption or fed to stock. Some of our farmers late years are putting their hay into barns too green.

New England agriculture with its western competition has been

able to raise more than any Western State per acre. Corn is our most important crop in Vermont and we raise 2,014,271 bushels, or an average of 37 bushels. A few years ago there was a prize offered to boys who would raise the largest crop and fifteen of them raised over one hundred bushels per acre. This shows what the possibilities of the crop are.

Potatoes are first and foremost of the root crops of Vermont, and he advised planting an early variety, and harvesting just as soon as the tubers were large enough. The disease known as rot and scab are communicated to the potato from the tops, consequently they should be separated as soon as it will do. Early dry potatoes, those dry early in August, should not be put into the cellar, but into a dark room until cold weather comes. If early planted potatoes are apt to be injured by the frost, would cover the tops with a horse shoe. This can be done any time before they are six inches high without injury to the plants.

COVENTRY INSTITUTE.

A meeting of the State Board of Agriculture was held at Coventry Wednesday and Thursday, January 2 and 3. Mr. William Barrows welcomed the members of the Board and visitors in a very happy manner. He said: The subject of agriculture not only interests you and me but every one. Every branch of business in the State is effected by it, and we of this county feel it an honor to have the meeting here, and are pleased to see so many from adjoining towns. We farmers in this vicinity have the same disadvantages and discouragements that farmers have in other parts of the State, and we need encouragements. Too many of us are in the old ruts. Farmers as a class are slow to learn and take advantage of improvements, and are less inclined to discuss our own affairs than any other class of business men. The speaker hoped that while the board was here and so many other agriculturists from other towns, that they would call it their meeting, and be free to ask questions and take part in the discussions.

M. W. Davis responded in behalf of the Board, and in the course of his remarks, he said: We felt the sympathy of your kind and generous hearts as soon as we entered your town in the shades of evening. On our arrival many met us with outstretched hands to cheer us in our work, serving to give us a good night of sweet rest, soothed by the words: "Good night; see you again in the morning." As the beautiful morning dawned upon us, your people were alive to throw around us pleasant associations by the showing of some of their manufacturers, and their beautiful stock, and now we are welcomed through you to this first session of your meeting. If this is the first advent of a Board of Agriculture to this place, I am infused with the idea from what I have thus seen and felt that Coventry should have the better meeting of the whole State. Farmers, bring out your wives, your young men, and we will have a profitable time together.

GRASS AND OTHER CROPS.

The first speaker on the list was Mr. Rolin C. Smith, of Pittsford, who read a paper on crops, in which he said in substance: Grass is king of Vermont, and corn next. Farmers should raise more corn. The fodder is worth as much as hay. He spoke of corn fodder and ensilage, and recommended raising evergreen sweet corn to help bridge over the short feeding months of July and August. Too many farmers are land poor, and too much land well adapted to cultivation produces nothing.

In answer to questions Mr. Smith said: I prefer the evergreen sweet corn for fodder; it should be planted thin enough so it will run, being useless if planted too thick. There is more water than milk in such fodder.

Mr. Chapin, of the Board: I have shown my faith in land and now own over 1,100 acres, and I once purchased 100 acres on the mountain of rocks and stump for just $10, and now it is well wooded over. Wood grows naturally in Vermont, even on our roughest land, and is valuable.

Mr. Story—I have serious doubts about fodder corn, consider it almost worthless unless well eared.

Mr. True—I consider corn fodder invaluable to a dairy farmer. Rowen is good, but in dry seasons we cannot raise it, and the corn plant does well in dry weather. We should feed cows grain 365 days in a year.

MILTON INSTITUTE.

At the second morning session Mr. Chapin, of the Board, read a paper on "Crops." He said Job's servants plowed with 500 yoke of oxen, and since that time great improvement had been made in that particular implement. Plowing is too often poorly done. It can be done more cheaply in fall than spring, as the time is not as valuable as in spring. He spoke of the great improvements of tools of all kinds, and mentioned particularly the disc harrow as one of the best pulverizers of the time. He would recommend the cutting of grain soon as grown, and grass crops before they are grown. Early cutting of wheat applies the same as other grain. Our average hay crop is 2,070 pounds per acre, and it should be double that amount. It should be cut between June 20 and July 10. Orchard grass is good if a man is smart enough for it. Should be grown on rich land and cut at least three times a year.

Our grain is grown as mixed farming. Four-fifths of the grain is grown by owners of the soil, and one-fifth by tenants. We raise more per acre than any other State. Our crops on our farming lands are valued at $5.56 per acre, while in the North Western States it is only $5.43 per acre. The possible yield of corn in the State is 100 bushels per acre, and the average should at least be 50, but it is less than 40. Sweet corn is rich in fat and albuminoids, the most expensive elements of human foods. Oats are well adapted to our culture, and a well-balanced food, and should be

more extensively raised. Barley is one of the oldest of grains, being spoken of in Scripture. It will grow in a wider range of climate than most any other. Will produce from 30 to 40 bushels per acre, often more. It weighs from 48 to 50, is a good grain to sow grass seed with.

In answer to questions Mr. Chapin said: I have used many hundred dollars' worth of fertilizers. I live in a high district, and use phosphates to hurry the crops along. Mr. Davis said, grass is king of Vermont, and corn is next to it. If every farmer in the State raised 65 bushels more corn than he now does the State would not have to buy any.

UNDERHILL INSTITUTE.

A fair-sized audience of representative farmers greeted the Board of Agriculture at Underhill. Frank Jackson was elected chairman, who addressed the farmers as follows: It is a great struggle for farmers to keep abreast of the times. We cannot cultivate our soil as our fathers did, the virgin soil, now we have to furnish to a greater or less degree the constituents of our soil. Formerly the man who did the most digging of the soil met with the most success, now it is the man who puts the most study and thought into his business, who is the most successful. The day has passed when any man can be a farmer. The farmer of to-day proposes to conduct his own business. He argues, and justly too, that his social and political position are as good as any one's. Our farms must pay more than living expenses. Vermont offers as many inducements to-day to the farmer as any other State in the Union. We believe in our own State. The product of the West is in reality as near the market as we are owing to the freight rates. All the products that we raise must be of first quality.

Our Experiment Station and Experiment Farm are great educators for its farmers. One would think to read some of the papers, that Vermont was all offered for sale and begging for a purchaser, but he was afraid the Swedes would find it different.

O. J. Lowrey, of Jericho said: I am in sympathy with what has been said and also with the workings of the Board. They are practical men and speak from subjects they are familiar with. He spoke very highly of the Grange both in its social capacity and as a State and national organization. Thought it brought the farmers together and was a great educator.

Mr. Chapin said he was in full sympathy with the Grange. The members of this institution take matters pertaining to their own business into their own hands. Think when the farmers wake up to their own position it will be better for them. Spoke of the times when we had farmer Governors and farmers for other State officers.

Mr. Chapin was the first speaker who read a paper on "Farm Crops." He spoke of the great improvement of implements and compared the present with those used 50 years ago. Do your work well, too much work is half done. Plow well and plow at the

right time. Land properly prepared is half of the battle. Farm manure is of the utmost importance; more should be saved and less bought. If you can make a dollar by buying commercial fertilizer then buy it, but study it well beforehand. Too many of our crops are not harvested in season. This is true of both grain and grass. On our million acres of meadows we cut a million tons of hay. By proper management we could produce much more. Orchard grass is a wonderful plant if a man is smart enough for it. It wants cutting three times a year. The corn grown in the United States gives to each person 35 bushels; in Vermont six bushels. Vermont should raise more of her own grain. Strawberries should be found on every farm and garden in the State; can raise them as easily as potatoes and about as many; modern implements have killed out most of the wild ones; some important points in the raising of this crop are soil, location and condition; prefer to set the plants on land that has had the year previous some hoed crops; prefer deep loam, warm and moist land; a good bed should yield a bushel to a square rod; must be kept clean. Crescent seedling, Bidwell and Charles Downing are good varieties; in gardening set the plants 2x1 feet; Crescent is a large producing variety but needs a stamenate variety with them about 1 to 5.

In answer to questions Mr. Chapin said: Wheat cut early makes better flour than late cut. Rye cut in May or June is good fodder and if dry makes a good feed for milch cows. Barley cut green makes a first-class feed to supplement pasture.

Mr. Smith, of the Board said: I raised two crops of barley on same ground the past year; cut both for hay and find it an excellent fodder for milk; does not produce as many tons per acre as one would think.

Prof. Cooke said: Barley sown in July is a good fodder to feed late in the fall. Frost injures it but very little. Barley helps balance the ration when feeding corn. Corn is not a perfect ration.

Mr. Winslow, of the Board said: Barley is one of the best crops to raise; wants rich land and to be sown early. I have raised 60 bushels per acre. It is good grain to feed cows; is healthy. The straw is worth more to feed than poor hay.

Prof. Cooke at the afternoon session said: It needs more intelligence to feed out a crop without waste than it does to raise it. Always feed for the health of the animal. Feed may not be unhealthy of itself but may be fed so as to make it so. Cotton seed meal fed when properly mixed will make a perfect ration, but fed alone would produce bad results. Pasture produces the most natural feed for animals, clover hay and corn meal make a good feed, the rate is about 1 to 6. Five quarts of corn meal is a heavy feed for a cow. Should prefer to mix the heavier grains with the lighter equal weights. Clover hay dies out the second year after seeding, but if cut before it seeds will last much longer. Timothy cut ripe is not as good as timothy sown or hay cut early. White clover lasts much longer than red.

DAIRYING.

BENNINGTON INSTITUTE.

Rollin C. Smith, of the Board, was the first speaker, his subject being "Dairying." He said: Dairying is the leading industry in the State. It is comparatively new. A little over a quarter of a century ago we were a sheep-raising and wool-growing State, and I doubt whether the State will ever be more prosperous than when we were selling wool for forty cents a pound, and had a good demand for our sheep. That industry came to a point where it did not pay; wool went down, the Western demand for sheep failed, and the State embarked in the dairy industry.

We have made very little progress in the last 25 years. Every one went into the business hap-hazard. Everything in the shape of a cow was brought into the dairy, and to-day too may dairymen have bred just as they bought, without any thought or care of what the animal was to be raised for. Too much of our dairy products are manufactured out of season. Too much butter is made in the summer months. The last week in August there were shipped to New York 4,000,000 pounds of butter, while the consumption was only 1,000,000 pounds. Just four times as much as the market demanded. Three million pounds had to go into cold storage. The market demands butter fresh from the churn, and that demand is increasing all the time. Too much butter is made in the summer and not enough in the winter. To remedy this evil more cheese should be made during the summer months. While there is justly a complaint made that a large proportion of our butter is of a poor quality, the same may be said of cheese. Our reputation in this State, as a whole, is not what it should be. Too many skimmed cheeses are put upon the market, and not enough whole milk cheeses. As the supply of first-class articles increase, the demand will correspondingly increase. First-class articles of either butter or cheese command a good price, even to-day, when prices are ruling so very low. Dairymen who have patronized first-class cheese factories the past season have no right to complain; they got good returns for their milk. Make more cheese and less butter in summer, and more butter in winter. We import nearly a million dollars' worth of cheese every year. It is a kind not manufactured in the United States to any great extent, but might be, and if it was made here in much larger quantities, the demand for it would correspondingly increase.

In speaking of creameries he said all business tends toward a center. We may not have hit upon the right plan as yet, but in a few years all, or nearly all, of our dairy products will be made up at a factory. Seventy-five different farmers will make as many different grades; one creamery will make but one grade, and that would out-sell and be better, as a whole, than the individual dairy butter.

Colonel George W. Hooker, of Brattleboro, was next introduced

as one of the farmers of Vermont. He said: I take great interest in the agriculture of Vermont, and I think I ought to. It is the basis of our prosperity, of our wealth and our happiness. People who do not take an interest in farming do not take an interest in the public welfare of our Commonwealth. I was invited to come here to talk about creameries, and if I had time would like to go into every town in the State and do the same thing. We built a creamery at Brattleboro two years ago. Village people took most of the stock, but farmers took some. What has been the result? We have raised the price of butter from 12 to 14 cents per pound, to where it netted 22 cents the past year. The first thing that we insisted upon was absolute cleanliness. The cream gatherers are the ones we look to for this part of the work. They are instructed not to take a particle of cream from any farm till they have first examined the stable and watering trough, and everything connected with the establishment, and not to take any cream unless everything is all right. Impure water is a source of much poor butter. One butter maker I know of ruined his butter by straining his milk by the light of a kerosene lamp. Nothing will take up odors like milk. Our butter maker uses 1½ ounces of salt to the pound of butter. He is very particular, and allows no one to smoke near his building, and the cream gatherers are not allowed to smoke on their routes. We have doubled the number of our cows and increased the value of our farms by this creamery. The first thing for success in Vermont is perfect health. Not only in the human family, but in the animal kingdom. Absolute regularity is what we need, not only in ourselves, but in our domestic animals. Eat regularly yourselves and feed your stock regularly. Bad drainage and poor ventilation are hurtful to all animal life; proper food and pure water, given at the proper time, are what we need. All farm stock should be fed in the day time. It has been estimated where a trial has been made, that fodder fed by daylight was worth one-fourth more than if fed after dark, or before light in the morning. Animals are constituted to rest at night and work by daylight. Every farmer should have a brood mare and raise at least one colt a year, and I think Vermont should raise its own beef.

BENSON INSTITUTE.

In the afternoon Mr. Smith in his address on summer against winter dairying strongly advocated the creamery system. He predicted that in the near future all the milk will be manufactured into butter at some central location. The operators of the creameries have a right to demand of the farmer milk from healthy cows kept pure and clean, and perfectly sweet, and delivered at the proper time. The farmers demand of the creamery an honest weight and an honest test. Milk, and even cream has a different value. I have no faith in testing milk by the per cent. of cream, especially after it has stood a half a day, and then been carted a mile or more to the creamery. You cannot get the full value of

the milk with the deep setting system. Why, then, should we expect full cream in the testing tubes. I think the oil or churn test the only perfect way.

Mr. E. L. Barber, of Benson, said if the hints of the speaker were heeded, and some satisfactory method was adopted in the creameries of that section, it would be worth more to them than what the meeting had cost the State. Mr. Barber also agreed with the speaker in the importance of early turning out of stock into the pasture in the spring. The element contained in the old grass on the ground was what the cow's system demanded. Early cut hay is indispensible to good stock raising. At present more hay is cut in June than in August in this section.

Mr. E. D. Douglass, of Shoreham, who has raised the product of his cows to over 300 pounds of butter per cow, said Vermont should double her product, and it can be done in two years with better care, better feed, and weeding out of the poor cows. He had never changed his methods of making butter, viz.: deep, open setting, and did not think there had been any improvement on that. He preferred the Jerseys for his business, and considered them superior to any other breed, but good cows could be found in any breed, and more depended upon the care, feed, and breeding for a purpose than the simple merits of any breed.

BERLIN INSTITUTE.

Mr. Smith, of the Board, on the second morning spoke of winter against summer dairying, giving the pros and cons of each. In answer to questions he said: I feed my grain dry, and do not cut the feed, but would prefer to if the expense was less. I would advise it where farmers are situated so they can moisten and mix grain with fodder. I do not think grain fed in the form of slop of any advantage.

Deacon Perrin said he had practised feeding his grain in slop form for a number of years, and knew he got more milk than if fed dry.

Mr. Smith said he would not warm water unless it was very cold; thought many farmers were over-doing the practice.

One of the best farmers in Berlin said he had warmed water for his stock nine years, and should continue. Others who had tried it had given it up as a useless expense.

BLOOMFIELD INSTITUTE.

Mr. Smith in answer to questions after his paper on the dairy said: I would prefer to have water warmed for stock as soon as ice appears on the trough, and don't think it would pay before that time. I would not advise raising the temperature above 55° or 60°, and think all ruminating animals will do as well and make as much fat and butter when fed twice a day as when fed oftener, as they have to remasticate their food before they can utilize it or receive any benefit from it. I prefer to feed wholly of the grain I

raise, but if I am obliged to purchase I buy cotton seed and bran. I raise corn and barley, and grind both together for a mixture of grains. Corn is always good, and in order for most any kind of stock.

COVENTRY INSTITUTE.

It was stated that milch cows should be fed a mixture of grain. I never saw a milch cow too fat for me. A farmer who lets his cows grow poor is losing money every turn. I like ensilage and put corn stover into ensilage. I have put corn into the silo before husking. My silo is made of wood. I have put clover into silos and like it.

Mr. Chapin: I plant my corn for fodder 3x3. I like Sanford corn for fodder, put five or six spears in a hill.

Mr. Davis: The business of a dairyman is to keep up the flow of milk, and bridge over the shortage in July and August. I plant Crosby sweet corn, but prefer to provide the year beforehand. I put up rowen or fine hay to feed in July or August. Dry clover is better than green. I feed cows grain, and it pays. Barley is one of the best crops for hay. Silos are the salvation of our country. I would sow three or more bushels to the acre of barley when intended for hay.

At the afternoon session Mr. Vail read a paper on the dairy, and answered questions as follows: Barley is a rich crop, but corn, where it can be raised, is the most productive and in dairying would recommend putting it in silo. The richest food for producing milk is grass cut before it heads out. Grass cut in this way is not so bulky, but the nutritive ratios are then most perfect. Rye cut at the same time makes a perfect feed and is good for early feed. Barley for hay can be sown late as it will stand frost, and make late feed. The cost of ripening, threshing, milling, etc., if taken out, will determine whether it will be the better to cut for hay or leave for grain. Some of my cows made one and one-half pounds per day. I feed spring cows through July and August with green feed, cotton seed meal or bran. My cows are Jerseys. They eat 7 pounds of grain and 15 pounds of hay per day, about 15 cents worth of hay and grain.

Mr. Richmond, of Newport.—My experience is that the poorest hay is that cut after the head and stalks appear, and before it blossoms.

Mr. Vail.—I should feed bone meal where the cows gnaw boards and bones. Bone meal is also a good feed for the production of milk.

Mr. Davis—I feed bran or ashes to cows thus affected.

Mr. Vail.—Bring up the fertility of the soil by feeding, and not with phosphates.

Mr. True—Corn bran is the best; that which has been handled the least.

The Chairman.—I have increased my hay crop one half. A dairy is the best stock to improve the land. I stable my cows the year round, and am well pleased with that practice.

DORSET INSTITUTE.

THE DAIRY.

Mr. Vail, member of the Board, from Pomfret, spoke of the dairy. In answer to questions Mr. Vail said: I have a theory that cows will often eat more hay than they need, and believe it injurious to them. I would not feed too heavily a cow that was inclined to fat. I should grind corn on the cob for cows. I feed my grain at two feeds. Any good cow is subject to milk fever, especially if well fed.

From an actual test I have made this winter 1½ pounds of butter per day from several of my best cows. The English standard ration for hay is three pounds of hay to each 100 weight of animals. I should feed no grain to a dry cow if in good condition.

Rollin C. Smith, of the Board, showed winter dairying to be much the most profitable for the following reasons: The winter cow goes dry in July and August, the months when milk is actually worth less than during any other two months in the year. Time on the farm is worth more at that season than in any other two months. A cow coming in in September will produce about one-eighth more than the same cow coming in in March or April. Dairy products always sell higher than in July and August.

EAST FAIRFIELD INSTITUTE.

Mr. H. W. Vail, of North Pomfret, member of the Board, delivered an interesting lecture on "Dairies and Dairying." Mr. Vail is a breeder of Jersey stock of the butter type, and has a large experience to draw upon. Along with the leading dairymen in Windsor county he makes butter in the winter. There are three important elements in a successful dairy: The man, the cow, and the feed. Where one of these is wanting there will not be very much success. There must be good cows and cared for intelligently. Those raising their own cows should be careful in the selection of of both sire and dam, with the special reference to the production of butter.

It is not always best to discard a heifer after one or two years' trial, as often these will greatly improve in production with increasing years and finally make valuable animals.

As greatly as the product of the dairy is being increased, he was of the opinion that the end is not yet reached.

Intelligent dairying in Vermont is the most promising business the farmer can engage in, according to his belief.

At the close of the lecture Mr. Vail answered a long list of questions asked by the farmers. He said that heifers should be kept growing from birth until two years old, when they may commence to give milk.

Would feed these heifers for bone and muscles rather than fat.

Does not like to feed young calves with rich Jersey milk, as it

will produce scours and loss of the animals. Mr. Winslow would give a teaspoonful of soda in milk. One or two doses will usually effect a cure in cases of this kind. Mr. Vail commences at once to feed skimmed milk, and after a few weeks give a little bran and oil meal. For winter dairy would feed 15 pounds of hay, or 10 pounds of hay and 20 pounds ensilage.

For grain, feed 2 pounds each of corn and bran, with 3 pounds of cotton seed meal, making 7 pounds a day for the largest cows. Is much in favor of ensilage for milk, has cows making 1½ pounds of butter a day on this amount of feed. Average amount of milk per cow 25 to 28 pounds. Sixteen pounds of milk will make one of butter. Has not yet reached 300 pounds per cow for the season. The cost of a cow's feed per day is 15 cents, and from a part of his dairy averages 45 cents a day of butter, at 30 cents a pound. Cows go dry about two months in the year. Would be careful to feed all animals in accordance with capacity to digest and assimilate what is given. With heifers good early cut hay with clover is sufficient without grain. Cows largely go dry during July and August. Sells butter to special customers in prints.

The large prices received by farmers in his part of the state may be attributed to Jersey stock, good keeping and special markets. If farmers there were under the necessity of selling their butter at "store prices" they would abandon the business and go into some other.

Mr. Chapin has increased his average product per cow from 100 to 200 pounds. Feeds early cut hay and can make money at twenty-five cents a pound. He likes grade Jersey cows very well, better indeed than the full bloods. Commences to cut his grass before it has hardly got into bloom and likes to get two crops in a season. Mr. Vail was confident that he could purchase all the feed for his cows and then make a good profit on it from the product of butter.

Mr Winslow upon request spoke of the value of the Ayrshire breed of cows for the diary. He likes the breed for the purpose. At three tests during the season he found it averaged to require 22 pounds of milk for one of butter. These cows are easily kept and give more milk than the Jerseys. The butter is not quite so deeply colored as the Jersey. They make good animals to sell, as they are fine looking and promise well for milk or butter. He stated that his cows, which come in at all times of the year have averaged for several years some 6,000 pounds each. This winter feeds good hay with from 1 pint to 6 quarts of wheat bran twice a day. The first is for those cows that are about dry.

The Secretary spoke a good word for Ayrshires for the production of milk. Has one cow that will give a yield of 8,000 pounds of milk for the year. It will require about 25 pounds for one of butter. At 22 pounds of milk for one of butter Mr. Winslow's herd would average 272 pounds for the year, and Prof. Cooke's cow 320 pounds at 25 pounds. This was a pretty good showing for this breed.

Mr. H. A. Soule reported a yield of 260 lbs. of butter each from 18 Ayrshire cows.

The discussion filled up the afternoon until the time for adjournment arrived.

EVENING.

A good-sized audience having arrived at the appointed time, the first exercise consisted of music, after which Rev. J. K. Fuller, of Bakersfield, gave a paper on "What makes the farmer poor?" This subject was very fairly and fully treated in a most interesting manner, and could hardly fail to produce an impression for good that should not soon be forgotten. Any brief abstract would not do justice to the subject; it should either have been heard or read to be satisfactory.

Secretary Cooke occupied the remainder of the evening with a lecture on winter dairying.

He compared the usual method of dairying with this. He stated that as far as he had been able to find out, the average amount received by the farmers of the town per cow through the season would amount to $35.00 for the butter. The skim milk should be worth 10 cents per hundred pounds to feed to pigs. It will require two tons of hay to keep a cow through the winter season, worth $10 per ton. This with $2,00 worth of grain per cow will amount to $22,00 for keeping, to say nothing for the summer pasture.

He is confident that what is called a winter dairy will produce more milk in a year than when the cows come in in the spring. This has been proved by numerous tests. The cows commencing to give milk in September and October must be fed liberally during the autumn and winter and on coming to grass will give a good yield in May and June. They will go dry in July and August, the poorest time to make butter in the year. A cow thus treated should give a yield of 5,000 pounds of milk in a year. To produce this amount the feed of hay and grain would cost about $34 per cow.

A stable in which cows are to be kept in winter should be kept above freezing. The deterioration of pasture is an argument in favor of winter dairying. The increased amount of grain fed will add to the richness of the manure, and this should help to make both meadows and pasture more productive. He was of the opinion that the net proceeds from the winter dairy, all things considered, would be double those from the summer dairy. The farmers questioned the speaker freely for the purpose of eliciting all of the information possible upon this subject that is comparatively new to most of them in this part of the state. He was of opinion that winter dairying must ultimately take the place of the method usually practiced. It will, however, require a good amount of intelligence, judgment and skill to make it really successful.

On a good hay farm this will continue to be a leading crop.

Next to this the corn crop will be worthy of much attention. Would put a part of this crop into ensilage and cure the rest. The ensilage and cured corn fodder and good hay will make a proper ration for milk. Realizes as much from an acre of Sanford corn in value per acre, as would equal five tons of hay. This was on the State Experiment Station farm. This crop was produced with the aid of mineral fertilizers alone.

A farmer inquired what would be done with the large amount of straw raised, if cows were to give milk all winter?

The reply was that where a pound of grain is fed a day to a cow, this will supply the deficient nutritive matter in the straw. But of course some hay would usually be fed along with the straw.

As to the kinds of grains to be fed with coarse fodders. Would not use corn meal, but bran, cotton seed meal in moderate quantities, and gluten meal. The last is especially valuable and safe. This is the residium of corn after the starch has been removed at the glucose factories. This gluten meal is worth more as feed than clear corn meal. A proper proportion and amount of these feeds, in all about six pounds a day for each cow, will make a good ration with the coarse fodders.

At the State Experiment farm they have eleven cows, embracing Jersey, Guernsey, Ayrshire and Shorthorn. It is intended to keep none for more than one year that fall below 250 lbs. of butter in yield. Of those now under trial perhaps three will have to be discarded, while three will go over 300 lbs.

The evening was very fully occupied in the matters here presented, in which the farmers appear to be much interested.

At the close of the discussion Mr. Perry Chase presented a resolution of thanks to the gentlemen of the Board and others who had contributed to the success of the meeting, which was responded to handsomely by Mr. Winslow, of the Board.

FRANKLIN INSTITUTE.

Rollin C. Smith, member of the Board, next delivered a profitable lecture on "Dairying."

Twenty-five years ago Vermont was better known from its sheep industry than dairying. There came a great change afterward and these two industries changed places. But there is not yet as much thought and intelligence put into the dairy business as used to be with the sheep. There must and will be much improvement in the future. One-fourth of the cows kept should be gotten rid of, as they do not pay for their keeping, while one-half of the remainder should be much better. A man must have some love and taste for his business if he is to be successful. He deprecated the idea of having dogs around to drive the cows, as they are usually a nuisance. Thought one-half of the farmrs were breeeding their cows without any special reference as to what is wanted of them. This should not be. There must be careful selection first, then take care of them.

Would pay particular attention to the raising of heifers for cows. Believes in exercise for them, with good care and feed; keep them growing right along and with a view to healthfulness and vigor. In winter would keep in a dry warm shed and feed plenty of early cut hay. Prefers this method to tying in stables. Likes to turn stock to pasture early, but would not forget to feed whatever hay and grain was necessary. The old and new grass does them good. The second winter with heifers would keep in stables and care and handle so as to make them kind and docile. Dairy cows are usually kept too poorly in winter; this is not profitable, as it will take a long time after getting to pasture to regain a fair condition in flesh and before they can give good returns at the pail.

He spoke of the importance of keeping up the flow of milk when the grass begins to fail in summer by extra feed of some kind. Keeps his cows in the stable nights during the entire year. As soon as there is any diminution of milk, gives extra feed, and finds the practice better for him than turning to pasture nights. He was of the opinion that in mid-summer it would be profitable to make more cheese. It would seem that there should be no necessity for importing any kind of foreign brands, as the best should be made in this country. He put in a plea for more of winter dairying, and would advise farmers favorably situated to try this method, as he believed it would be to their advantage. He spoke strongly in favor of raising more of the grain that is to be fed on the farm.

At the close of this interesting address G. S. Fassett, being called upon, made some most interesting remarks. He gave some of his own experience in farming. When he first commenced he only made 130 lbs. per cow of butter. Now he can keep twice as many cows and does not make less than 250 lbs. of butter per cow and sometimes up to 270 lbs. Average price the past year, 24 cents per pound. He never feeds to exceed $4.00 of grain a year to a cow. Thought that our abandoned farms could be made profitable again by dairying; would have these farms occupied by the native stock rather than foreigners. He spoke a good word for the Jersey cows, for the butter dairy. Mr. Fassett has a good grass farm, and buys his grain. This concluded the exercises of the forenoon. There was a very good attendance for the first session and a good degree of interest manifested by the farmers in the subjects discussed.

Other questions were answered by Mr. Smith. At present he is getting $1.10 per hundred pounds for his milk, taken at the door and the skim-milk returned. Will make about six pounds of butter to a hundred pounds of milk. Which is best for the farmer, a special butter cow or a common purpose one? If for butter would have a special butter cow. Beef is of little value to him at present prices. In feeding grain would choose a medium quantity, neither too much nor too little. Some cows make a good use of much more than others. Feed as the cows require.

Is the average creamery a benefit to the farmers? Yes, decidedly. This work must be concentrated in some way. Methods may change, yet the principle of co-operation or work on a large scale, will remain the same. If the butter extractor proves a success, what will the effect be on the farmer? Mr. Winslow thought that as the butter would be sweet when made, more of it would be likely to be used, and that would be of benefit. What the future of this system will be time alone can determine. Would winter dairying be profitable with present prices of grain? Mr. Chapin thought that it would, at least he finds it so, and he likes this method.

GLOVER INSTITUTE.

Rollin C. Smith, of Pittsford, was the first speaker, his subject being "Summer and Winter Dairying." Where a farm is adapted for it, he gave winter dairying the preference as being the most profitable, work coming at a season of the year when it is worth less and no cows to milk in the busy season; cost of keeping very little more than for summer.

In answer to questions he said: "I would feed my mowing lands in the fall to a certain extent. I can get more milk by letting the cows eat off the grass than to mow and feed it in the barn; do not think it injures the mowings if not fed too close; should not cut rowen and turn on after that, and would not turn on to a newly stocked field if the sod was not firm.

Mr. Vail said: "We have different experiences, I cut grass in September and feed my cows in the barn. My high meadows have improved since I stopped feeding; I would rather not buy anything that I can raise, but think cotton seed meal and bran can be fed to a profit."

Prof. Cooke said in regard to butter making: There are four essential things that must be regarded in butter making, and with either of these left out your effort will be a failure; good cows, good feed, absolute cleanliness, and a man of good judgment. A cow may be a good butter animal and not make so large a quantity; it is the flavor more than quantity that commands good prices; there are certain breeds called butter breeds, but there are good cows in all breeds; the individuality of the animal is what we should look after.

No cow can give good milk and not be perfectly healthy; if you feed to excess of the heat-producing foods it will not injure the animal, but the muscle-producing foods fed to excess are injurious. Clover and rye, the strongest muscle-producing foods we raise on the farm, if fed in excess are liable to produce fever. Anything that changes the normal condition of the cow injures the milk. There are two elements most liable to injure—one is food that animals eat, and the other what the milk absorbs; because fodder has a strong odor it does not necessarily follow it will injure the milk.

Milk should be taken from the barn as soon as milked; nearly

all dairymen have clean pails, but it needs more than clean pails to get pure milk; must have clean cows and neat milkers.

Either the deep cold setting or the separator will produce more butter than shallow setting, but under favorable circumstances as good butter can be made from one as from the other. The market does not inquire how the butter is made, but a good article is what is demanded. Butter will act just the same in churn when soured with vinegar as when ripened, but the flavor is ruined. Cream must be ripened to a certain extent; ripe cream not only makes better butter, but more of it. Butter perfectly fresh finds quite a market in New York city. Cream set 24 hours, if well stirred, will be fit to churn. Cream can be handled so that the buttermilk will be too poor for cooking purposes, there being so small a quantity of butter fats in it. We want a churn with no inside fixings, a barrel, box, or swing churn; should churn to a granular form, as it is more easily washed and managed; should wash with water cold enough to chill the particles so they will not adhere; white caps are caused by cream being over-ripe, and the dryness of particles on it.

GRAND ISLE INSTITUTE.

The first subject of the evening, the "Production of Cream," was considered in a good address by H. W. Vail.

The most important point to consider is, how is this to be done so as to leave a margin of profit to the producer. It is calculated that it costs about $35 per cow to keep a year. It this is so it is to be feared that the average receipts will hardly pay the cost of keeping. Thirty dollars per year from the cows of Vermont is an average price. There are some dairies that bring to their owners $60 to $90 a year. In order to make our dairies pay we must have better cows and care for them in a superior manner, providing a proper kind of food for the production of butter. Was satisfied that winter dairying would pay better than the old method. Would aim to get 300 pounds per cow, as with the best arrangements he thought this could be done. Where this can be accomplished there must be a margin of profit to the producer.

At the close of his remarks he answered many questions from the farmers present. First would have cows that it will pay to feed well, as some will do much better than others. He weighs the milk from his cows and finds a benefit from so doing. Feeds and waters twice a day. It may not be necessary to give water twice a day when ensilage is fed. Uses the old-fashioned slip stanchion and likes this method well. His dairy averages over 250 lbs. per cow. In winter has found that 16 lbs. of mixed milk would make one pound of butter. Never has tested a cow in winter that took over 20 lbs. of milk for one of butter. In summer will require more than in winter.

The ensilage from peas and oats is wilted somewhat and put uncut into the silo and pressed hard. Does not weight cut corn ensilage very much; some do not at all.

The first regular subject for discussion was upon "Dairymen," and R. C. Smith, of Pittsford, the first speaker.

He was of the opinion that many of the farmers of the State made a mistake when they changed from the keeping of sheep to dairying. When they commenced with cows they did not make a proper selection. With too many the idea has been that a "cow is a cow," without much regard to her real value for the production of butter. We have too many cows of an ordinary kind and they are not cared for as they should be. The remedy is test the cows, weed out the unprofitable ones and keep the rest better.

He was of the opinion that the State should do something in the way of establishing dairy schools for the benefit of this great industry. This is done in other countries with good results, and there is no reason why it should not be in Vermont.

Farmers in raising their own stock for the dairy should endeavor to keep their animals growing steadily from calfhood up to the period of milking, not pushed too fast but with a thrifty, continual development. He spoke particularly of the importance of good treatment through the winter. Cows should not be allowed to run down in condition while dry, but be well cared for, so as to give a good return when again commencing to give milk. In summer he prefers keeping his cows in the stable during the night in preference to turning into pasture. They need some rest and a good stable is the best place for them. He would always provide plenty of soiling crops to feed when the pastures begin to fail and the milk to decrease.

In his own experience finds that corn produces the best results. Always plants, in hills as that sown thickly broadcast is worth but little for the production of milk. The nearer matured it is the better it will be. It is now being found that corn for ensilage should be nearly mature, as it will then give much better results. Would by no means feed cows more than twice a day in winter. Cotton seed meal and bran should pay a profit on cost of purchase to use.

Thought that calves would do well enough in winter with good early cut hay and no grain. Perhaps a little bran might be useful. Would handle young animals so as to make them quiet and peaceable. Corn and barley make a good feed for cows giving milk.

At the conclusion of the address of Mr. Smith, Mr. Vail, of Pomfret, followed with some excellent remarks. We should endeavor to produce more from our land and from the cows. Keep less cows and care for them, so that they will do much better than now. He thought that if fed judiciously it may be profitable to purchase grain. All of his corn goes into ensilage, also four acres of peas and oats. Would feed liberally of bran and cotton seed meal, as this is considered very profitable.

Prof. Cooke stated that Vermont had beaten the world on good butter at the great exposition in Paris. It has also made a good record at the New England fair. We are making too much of poor butter, and there needs to be a reform in this respect. To

get the best foreign markets requires a better grade of butter. Mr. Chapin was of the opinion that we might find a fair outlet for our surplus butter in Florida, Central and South America.

Mr. Winslow, of Brandon, would breed up the cows to a better standard of production. He would weigh the milk sufficiently often to know what each cow is doing through the season, in order to find out what animals are worth keeping. But how about the quality of the milk? as sometimes cows that give a comparatively small amount will make as much butter as one that will give twice as much. Mr. Smith considers the best way to test cows is to keep the milk from each one separate long enough to get sufficient cream to churn.

HARDWICK INSTITUTE.

The question whether cows should be eating their feed while being milked was ably discussed by Messrs. Bronson, Blake, Vail and Davis. Mr. Coxe, of Walden being called upon gave a report of his dairy of Jersey cows as follows: This year there were in the herd six 2-year-olds, four 3-year-olds, four cows, and they made 287 pounds of butter per cow. Last year with a smaller per cent. of young cows made 294 pounds per cow. In 1887 all mature cows averaged 302 pounds per cow. My feed in winter is two quarts of meal, corn, and cotton seed with same amount of bran and good hay.

JOHNSON INSTITUTE.

The president introduced Mr. M. W. Davis, of Westminster, a member of the Board, who spoke on the "Management of Farm Stock."

Mr. Davis said that the objective point of agriculture is the utilization of our crops and stock in such a manner as to produce the greatest amount of profit. Probably three-fourths of the stock in Vermont would pay a larger profit than the whole, consequently the one-fourth should have been annihilated in the early winter. Too many farmers do not understand their stock and feed too many worthless animals. The crude material in barn and storehouse should be looked upon as so much butter or beef and fed only to such animals as will respond in a satisfactory manner. If you are dairymen, the great importance is, first, the animal; second, the feed; third, the man. In the dairy you should select the cow that can utilize the food and respond in a manner that will pay a profit We can only improve by better feeding, better care, but mostly by better breeding. This can be done by breeding at less cost than by any other method. Economy is the central idea in raising farm stock. There are too many signs of farmers buying grain. When you look upon your hay and grain, look at it as so much milk and butter. Keep cows that are adapted to the specialty you are pursuing.

Kindness has much to do with the profit of any animal. All animals are sensitive and creatures of habit. The dairy cow is an

animal that should be regularly fed and, if for butter, should be fed on butter producing foods. Late cut hay that has a large amount of fibre in it is almost worthless. Farmers must have a natural taste for the business they pursue.

In answer to questions Mr. Davis said: Any man who can raise clover has a godsend. It is the best food a cow ever took. Cut it as soon as the blossom appears. I would cut timothy as soon as the blossom appears and would rather cut before than after.

In answer to Mr. T. J. Baker, Mr. Davis said, I feed what you would call four times but really three times and I want this fed but little at a time. We should not disturb animals after feeding. I feed largely of brewery grain, which is an excellent food. I water twice a day. My cows stand in the stanchion every night in the year. My object is to get the largest amount of milk. I salt every day. If you cure your grain for the threshing machine I should use the straw for bedding only. It will enhance the value as well as the bulk of the manure. I keep my cows for the production of milk to be sold to customers. Mr. Davis was listened to with much interest throughout.

MILTON INSTITUTE.

A meeting of the Vermont Board of Agriculture for Chittenden county was held at Milton last week with a large attendance of farmers, and it was noted with satisfaction that the wives and daughters manifested an interest in the welfare of their homes, and presented themselves in more than usual numbers. The exercises were interspered with music by the choir, and organ accompaniment. President Ladd, of Milton, presided in a very acceptable manner. The sessions of the first day were of great interest, but the evening session was most valuable. The president introduced M. W. Davis, of Westminster as the orator of the evening.

Mr. Davis said he did not come there as an orator, but as a farmer from the farm to talk to the farmers. He believed one great mission in life was to make progress and improve. Vermont is a peculiar State, and the better it is known, the better beloved. The business of the farmer is to put seed into the ground in spring and gather into barns and storehouses in summer and autumn for support the rest of the year. Adaptation to any kind of business is the one essential qualification. Farmers are too apt not to know as well as they should their own business. They do not fully understand their own stock; are not acquainted with their animals as to which are the paying and non-paying ones, and I venture to say if one-quarter of the farm stock in Vermont had been annihilated last fall we should be better off. There are cows in Vermont that will not raise six per cent. of cream, while the average cow should make at least 225 pounds of butter. Cows are the salvation of the State. Western beef has destroyed our beef industry. Feeders should know what kind of an animal to feed and then know what to feed it. Time of cutting and curing hay is too often neglected. Dried grass instead of hay is what we want to look after. One

farmer in Craftsbury has made as high as 600 pounds of butter per year with no grain. This cow was fed on hay raised on ground that was mown four times a year, and fed no grain. The best dairy man in Herkimer county, N. Y., says to feed dried grass; mow early and often. Farm stock are creatures of habit and regularity in feeding and watering should not be overlooked. I believe in warming water for cattle and having them treated carefully and regularly. Mr. Davis explained by the use of charts the value of the different kinds of fodders and grains; also the fertilizing values of different grains after passing through the animal. He recommended where the farmer has grain to buy that he buy that which would most enrich his land as well as be better feed for the stock.

In answer to questions Mr. Davis said hay is worth the most for feed just before it blossoms. The nutritive ratio is then 1 to 5, after which the ratio widens. Do not think root culture profitable as ensilage will take its place with less expense. We are apt to feed too many times a day. I would as soon have northern corn ground on the cob as clear western meal.

This last assertion provoked some discussion and a physician present said the cobs were worse than useless, and an animal would require more grain with than without. Wheat bran was no better than saw dust. The experience, however, of the best dairymen in the State testifies otherwise.

PLAINFIELD INSTITUTE.

Dr. Lazelle gave the opening address. After welcoming the visitors, he asked what is the trouble with the farmers? He said: There is too much waste land on the farms. Land should be made to produce to its fullest extent. On my farm of 18 acres I have succeeded in clearing it of weeds; have my pasture as well as meadow in grass. Grass is the most profitable crop a farmer can raise.

Rollin C. Smith, of Pittsford, was the first speaker. Subject: "Winter vs. Summer Dairying." He gave a short history of the dairy business of Vermont, and spoke of the pros and cons of winter and summer dairying; said every farm was not adapted to winter work, but where they were more should attempt it. In answer to questions Mr. Smith said, different dairies require a different temperature in churning; the higher grade Jerseys or any breed that has been bred expressly for butter making requires a higher temperature than others. Raised his cream in shallow, open setting; ripens at 70°; churns at 67°; thins the cream with water to the required consistency; there is a waste in the thick cream; prefers a barrel or box churn; any churn without floats, either revolving or swing are good; preferred to have the butter granules larger than wheat. washed with brine the first time washing; worked from 12 to 24 hours after churning.

J. B. Pike, of Marshfield, said: Our cream is raised in Cooley creameries; have made tests with Blanchard and Stoddard churns,

bringing the butter into a solid mass with the Blanchard, and to a granular with the Stoddard; can always get the best returus in churning into a solid mass rather than washing the small granules; think there is a waste when the granules are the size of kernels of wheat; 62° is warm enough in July, but later in the season it should be warmer.

Prof. Cooke said: I do not agree with Mr. Pike; we can get all the butter in granular form; we analyze both skim and buttermilk, and know when we get it all.

Ira Stone said: We salt the first cream; sometimes keep a week before churning. Before we practised this, always had white caps, more or less, but we never see them in solid cream.

At the evening session Mr. Davis in his remarks on Vermont and the farmer, said Vermont has given 250,000 young men and women to the West, and we are proud of it. They have built up a society that never would have existed had it not been for Vermont. Vermont can raise more corn per acre than the West; also wheat, rye, and other grains. Spoke of men in the West who wanted to swap Western lands for Vermont farms. Vermont is a productive State, and it becomes us to make it more and more so. Farmers are apt to be dissatisfied with their business and be shifting from one thing to another, from cow to sheep, from sheep to horses, etc.; we must stick to what we have. It is impossible to farm it as we did thirty years ago and make it pay.

Albert Dwinell, of East Calais, said: As a man thinks so is he. Farmers should take a higher stand. He should love his business, have a love for his stock. We can educate our boys to love the farm and love the State.

L. W. Pike, of Marshfield, said: These are called hard times. If we should put more knowledge into our business it would not be hard times. If every dairyman made 300 pounds of butter per cow, as some do, instead of only 100, as many do, our incomes would be very much increased. It depends upon the cows and the feed. It costs about $50 to keep the 300 pound cow, with a profit of $16, beside paying a good price for what she eats; while the least cost of a poor cow will be $37, and her product will be only about $25, an actual loss of $12. Two hundred pounds will make the ends meet. We do not produce enough per cow. Our young stock is not well enough fed. Too many farmers find them worth no more in fall than in spring. We want more intense farming.

Judge Fisher, of Cabot, said: Farmers should be educated to produce more and buy less. Too many of our farms have mortgages upon them. Must make the farm pay more; raise more corn, more pork, etc., and buy less fertilizer. Make the cows and hogs make the fertilizers instead of buying them.

NORWICH INSTITUTE.

At the second day's session in the forenoon Mr. Winslow, of Brandon, delivered an address on sheep husbandry, in which he

gave a history of the different kinds of wool, and the climatic influence on the strength of the fibre. He spoke of our dry and greasy wools, and for what they were most valuable. There will always be a demand for our best sheep to supply the breeders in South America and Australia. Sheep degenerate in warm and dry climates, and will always need an infusion of our best breeds.

Mr. Miller, of Pomfret: We have never changed our sheep, and keep as many now as ever, and have bred for a long staple respecting the short staple. We find them more hardy; sell our wool for combing at very good figures; can breed Merino sheep for mutton to a certain extent, but should prefer a mutton breed. We wash our sheep and they shear about eight pounds. Wool sheared in April is as clean as the washed wool taken off in June, and the price of wool is not equalized to the quality of wool. We have had a fair market for our rams; do not practise housing our sheep in summer. I think too close housing in summer impairs the health of the sheep, and wool is worth as much when the sheep run out all summer.

Our dairy pays better and has for a few years past. We contract our butter for 30 cents. I think ten sheep will eat as much as a cow. I usually feed grain to sheep all winter, feeding a quart of corn to ten sheep. I prefer a mixed stock on a farm.

Mr. Winslow: Sheep are only housed for the appearance, just as a man fits his horse for the market. It is the appearance of an animal that makes it attractive and helps to sell it.

Prof. Cooke: The keeping of sheep in pastures has a tendency to kill out the weeds and poorer grasses that cows do not eat. Pastures can be kept down by cows if overstocked. I think the farmers would not mind the keeping of a few sheep. They produce quite an income over and above what would otherwise be obtained. Mixed farming is quite an important idea. We are a dairy State, but we should raise a mixed stock. The future of sheep husbandry looks better than for a number of years. The keeping of sheep produces a valuable fertilizer, and a small expenditure of money starts a flock of sheep. The cost is much less than for either the dairy or horse breeding.

At the Massachusetts State meeting of agriculture, it was stated that dogs had literally driven sheep from the western part of the State, which is particularly adapted for sheep raising.

A gentleman from Connecticut: The time was when every farmer in central Connecticut had from 25 to 50 sheep, but now they cannot keep them on account of the depredations of dogs. Killing and mangling are not the only bad results, but dogs frighten them so they will not fatten so well.

RANDOLPH INSTITUTE.

At the evening session, Mr. Smith, of the Board, spoke on Dairying and the Dairy interest in Vermont, and answered the following questions:

Mr. N. L. Boyden asked: What age do you turn a calf out to grass?

Answer—As soon as two months old if spring calves, but do not take the milk off at the time; prefer to feed milk till four months old. Want a calf to learn to graze and develop its muscles. A cow to pick her living in our rough pastures should be a good traveler.

Luke Parish asked: Do you grain your calves?

Answer: I do not think it necessary if the calf has fairly good pasturage. Do not want to grow a heifer calf too fast. Neither would I stunt one. Be 365 days in growing a yearling.

Question—Mr. Boyden asked: How long should a cow go dry?

Answer—In a dairy I prefer them to go dry two months. Individual cows might be milked longer.

G. D. Hazen asked: How many times do you feed grain?

Answer—If you are feeding heavily should feed twice, but ordinarily only once.

G. F. Nutting asked: When feeding cows corn meal, bran and barley, what increase should I get by feeding cotton seed meal? Also asked, how much is gained by feeding sour milk and buttermilk?

Mr. Smith said he could not answer these questions, as he had had no experience in that manner of feeding, but should not advise sour milk for butter cows.

Mr. Nutting said that he increased the feed of his cows by one quart of cotton seed meal, and what sour milk and buttermilk he had, and he had got a gain in butter from "13 to 21 pounds" per week (five cows).

Mr. Parish asked: How about taking our milk to creameries?

Answer—We may not have hit upon the right principle as yet in our creamery system, but all business tends toward a centre. I think if all the milk in this town was manufactured into butter by one creamery it would bring much more than it now does. The amount they would handle and the appliances they could afford to have and the constant attention they could afford to give to it, would insure a better and uniform product.

Mr. Boyden said: How are you going to get an equal test?

Answer—Where whole milk is taken to the creamery there is a difficulty. I do not believe that a perfect sample can be dipped from milk that has creamed and been carried to a creamery. You may or may not get cream into your sample. Take samples from both night's and morning's milk soon as milked, and test from them. Should prefer a chemical test.

Mr. Hyzer asked: Did you ever dip a test with a tube?

Answer—I should have no faith in any kind of dipping from milk that had been once creamed.

Mr. Boyden asked: How long will it take to raise cream at 50°.

Answer—If in cold, deep setting, you will most likely get an imperfect separation at that temperature; 45° would be better. It will depend on the cows as to the length of time to separate. Some cows will make a perfect separation in two hours, but the cream will shrink in bulk the longer it stands.

J. B. Adams asked: Would the same number of spaces from different dairies make the same amount of butter?

Answer—Some cows raise a cream more dense than others, consequently more butter fats; but those who try it say the spaces, if raised in the same temperature, and gathered at the same time, will make a basis for discussion practically correct.

Mr. Granger asked: Do you perfer stanchions to fasten your cows?

Answer—Yes, but prefer some swing stanchions to the rigid ones. I do not warm water for cows; think it is useless; if the cows stand in warm stables and the water has no anchor ice. Do not want the cows chilled when they are let out to drink.

ROYALTON INSTITUTE.

Mr. Skinner, of Tunbridge, an enthusiastic dairyman, who has made some wonderful records with his few cows, said: I am glad there was such an institution as the Board of Agriculture and an Experiment Station. If there is any success in farming the most important thing is doing the chores. The cow is a servant and a very important one for the State of Vermont. She not only furnishes us with the necessities but the luxuries of life. I will not even except the Morgan horse. I have engaged in butter-making for 27 years. My object was first, to make an honest living, and second, to make a worthy article and in both I have been moderately successful. To be successful in any kind of business a man must be adapted to it. This is as true in dairying as anything else. The selection of cows is the next important thing. No man can afford to keep a poor cow. To test a cow—which every owner should—you first want to know the amount of milk yielded, color, time taken for it to cream, solidity of cream, time of churning, amount and texture of butter. My cows stand in stanchion.

No man can afford to keep a cow poorly fed. Good care and good feed are essential. Milk from a cow poor in flesh can not make good butter. Hay should be cut in June. Cows do best in pasture in the same month, and grass is worth more at that time of year. Cut second crop of hay in August, and feed meal and bran as circumstances require. I feed bran the year around and corn meal part of the time. I feed no corn meal just before nor just after calving. I vary in feeding corn meal from one to four quarts per day, as the condition requires. Should always feed liberally. Corn meal always makes good butter. I feed my cows in this manner: 1st. Feed hay in the morning and water in the barn, then feed meal and card them. Consider carding very essential. At 3 P. M. feed meal and bran, after which feed hay. I make only two feeds in a day and only turn out of the barn in pleasant weather. Quiet and comfort are indispensible, and are of more importance than feed—or, at least, how they are fed is of little importance without quiet and comfort. The nervous condition of the cow effects the quality of the product, and if frightened

badly will have little or no cream on milk. Should strain milk through a fine wire strainer and a knit cloth. Skim before sour. Churn twice a week, wash till clean, and salt it on butter worker. From May, '75, to May, '76, our cows averaged 335 pounds, and in the next year 413 pounds per cow, besides supplying a family of three persons with milk and butter. Think cows running together will do as well as when kept separated. It is safe and profitable to feed meal in summer. Milk will shrink in quality as well as quantity in summer. Much of the poor butter made is predestined before the milk leaves the cow. By all means keep the cows in perfect health. Some men will feed to a profit where others would feed to a loss. A good horse is an animal of nerve and spirit, and a good cow should be constituted the same.

WESTMINSTER INSTITUTE.

Mr. Smith's talk was clear, exhaustive and commanded the closest interest of his audience. He said: Dairying is really a comparatively new industry in this State. A few years ago Vermont was a sheep and wool raising State. I doubt if it was ever more prosperous than then. Merinoes were brought from Spain and from them sheep were bred that went back to Europe and took first prize there. Westminster had the honor of raising that sheep [applause]. But the sheep industry became unprofitable and all our people rushed into dairying. As a result the 230,000 cows in the State average 3,250 pounds of milk. There must be something wrong about such a showing when there are cows that are giving 6,000 and 10,000 pounds and upward. The average yield of butter is less than 130 pounds. The trouble is that no attention has been paid to breeding. One quarter of the cows in the State are absolutely worthless. Another trouble is with the farmers. If one-fourth of the cows in the State could be annihilated and their feed given to the other three-fourths the dairy product would be increased. The speaker recommended no particular breed; all had their good points; but advised breeders to choose the family coming nearest to their ideal and breed for the characteristics of that family, without going outside. For breeding, he said, get stock that you can trace back as good breeding stock through three generations. Never cross a breed. Have similarity in your stock. There is a great deal in rearing. If half as much thought was given to the dairy business as was given to sheep raising twenty-five years ago the dairy product would be doubled. Calves must be raised for the dairy with as much care as is given to the rearing of other stock for certain purposes. Over-feeding is worse than under-feeding. The first three or four weeks calves should be fed good, sweet, warm milk. After they were two months old they should be turned out to pasture. They need this to develop them and train them to travel and to graze. The best grazer will make the best milker. Commence feeding at four weeks old. There is a great mistake in weaning too young. The barn must be dry. Winter entirely with hay. Stock should go to

pasture early in the spring. It is a mistake to suppose that cows must have a large amount of feed before them all the time. Cows need rest more than any other domestic animal. It is becoming more customary to have cows stand in the stable every night of the year. About the fifteenth of July have something raised on your farm to supply the defficiency in feed. In July the butter market is going down. In September it has got down. If June is the golden month for butter making October is the diamond month. The market is looking up and we are on feed that practically costs us nothing. Most of what was called good butter twenty-five years ago would hardly pass for that now. Consumers are gradually working onto sweet cream butter. Too much butter is made in the summer and not enough cheese. We hear a great deal about poor butter and very little about cheese. We don't consume one half the cheese we should if it were made better. The cheese men in Vermont have no need to complain of hard times in the last two years. If the greater part of the dairy product were made into cheese in the summer months the dairy business would be more profitable. If we have a winter instead of a summer dairy the cows should come in the 15th of September. They will produce more at a time when prices are higher and the milk is richer so that more can be got out of it. Then we shall be making butter when the prospects are growing better instead of poorer. The cows must have first-class hay when they first come to the barn, instead of the poorest, as is usually given. If I have good fall feed I can make enough to winter them if I get $10 a ton for hay from the cows giving milk. The barn should be warm but not by stove or steam heat. Then when you come to spring you have cows in good condition and the only trouble is to get them dried up sufficiently to put them out to pasture and get rid of milking when help is valuable. When we take our milk to a creamery that is making over 2,000 pounds of butter you cannot tell one pound from another. It all sells alike. But if the 40 different patrons each made his own butter there would be 40 different grades and you would be lucky if you did not get 40 different prices. Make it all at one price and of uniform grade and more money will come into the township. It is just as important that animals have time to digest food as to eat. I now feed twice a day, a little hay, grain, coarse fodder, etc., in the morning. Then the barn is closed until 4 P. M. A great amount of exercise is not necessary for cows. Very few in the State of Vermont do not get plenty. My cows stand in the barn twenty-two hours out of twen-twenty-four. When cows first come to the barn and change to dry feed they will drink heartily twice but along in November they will begin to need to drink but once a day. It is a question whether it is desirable to water oftener.

To Mr. Jennison, of Walpole, the speaker said that he would never warm water if the barns were warm or if he had a spring that did not freeze over. Cows should not be chilled but a great deal had been said on this point to humbug farmers.

To Mr. Chase: The animal's system needs salt. Generally speaking it is necessary food for the cattle kind.

To Mr. Haddam, of Putney, the speaker said that he should recommend swinging stanchions and to George Bidwell he said that rock salt was best and should be kept in the manger always. In reply to a further question from Mr. Bidwell he recommended for grain feed, bran, corn cob meal, shorts, linseed, gluten, cotton seed, a judicious mixture of which would make excellent food. A formula for mixing could be obtained from the Experiment Station.

To Mr. Haddam: There is butter and health in bran.

To D. K. Barry: Want stock watered before eating grain. It is not essential to water more than once a day.

Two or three more questions were asked and George M. Chase, the irrepressible, once more took up his disputation over the feeding of salt, the taste for which in cattle he claimed was acquired and unnatural. Mr. Smith and Mr. Vail declared that salt was necessary in a dairy that is run for profit.

The discussion was led by George Wright, the energetic manager of the Valley creamery. He believed that dairying was the primary interest of the State of Vermont, an interest we can rely on to bring us in our daily bread as well as butter. It is the farmer's bank from which he draws continually. We have heard a good deal of hard times. We have now had explained to us what is the trouble. The animal is not to blame. The trouble is in its treatment. When we are educated up the fact that we must use the cow in a decent manner, feed her well, we shall find that farming pays better. The speaker noted the fact that while the average make per cow for the State is less than 130 pounds of butter there are over 20 herds that average 300 pounds.

Mr. Smith spoke of the good pay (22 cents a pound) received by the farmers from the Valley creamery and said that creameries were something we had got to come to.

To James Ellis: I think butter can be made in winter for 14 cents a pound.

A. J. Willard wondered how the farmers lived between 1850 and '60 when butter brought 12 to 15 cents a pound.

Mr. Chapin, of the Board, rose to speak on this question but first wanted to say a word on the salt question. He thought salt was a necessity because the Bible said the righteous are the salt of the earth and the righteous are certainly a necessity. He then recalled the turning of Lot's wife into a pillar of salt and said that people who had been to Sodom and Gomorrah couldn't find Lot's wife. The cattle had licked her up. He then said that the reason why farmers could live in '50–'60 with butter at 12 cents a pound easier than now was that the extravagance and scoundrelism begotten of the war was poured out on this generation, and the sooner we learn to adapt ourselves to present conditions the better it will be for us.

FEEDING FARM STOCK.

COVENTRY INSTITUTE.

Mr. H. C. Cleveland is a cattle feeder on quite an extensive scale for Vermont. He is feeding this winter 68 head, which he intends to market in February or March. He begins to feed grain as soon as he puts up, and increases very gradually till they will take 10 or 12 quarts of corn meal per day, and feeding hay only twice and watering but once. The stock stands in the barn all the time except when let out to drink. Mr. Cleveland's barns and farm buildings are a model for neatness and convenience. He buys his corn by the car-load, and grinds it on the farm with a small mill run by steam. Last year his cattle weighed on an average about 1,400 pounds. He sold for 4½ cents per pound alive. In dressing the shrink was only 30 per cent. of the home weight.

GLOVER INSTITUTE.

Prof. Dole, of Northfield, said: Heard a manufacturer say farming ought to pay now, a few years ago it paid and produce sold as low and the supplies were higher than now.

Mr. Chapin said: Plenty of Vermont farms would support families if it were not for the mortgage and high taxes. Vermont exempts too much property from taxation.

Mr. Geo. Brewster, of Irasburgh, said: I manage to farm it and not buy any feed; believe in raising instead of buying; feed well and can raise my corn cheaper than paying for freight and commission.

L. W. Patterson, said: I feed some grain, but cut my hay twice; cut before it heads out and cut second crop in August; when hay is cut before it heads out it will start up readily for the second crop; feed my full cows four quarts of bran and what of this dried grass they will eat; make ten pounds per cow per week; one-half the bulk of my hay is worth as much as if cut later; do not have to color my butter; cows are grade Jerseys; think I get a third more value from my hay by cutting twice; think it pays to buy feed; cut the first crop somewhere about the 10th to 20th of June, second in August; do not pasture meadows.

C. C. King, of Albany, said: I keep 18 cows, 5 of them 2-year old heifers, feed meal year around and think it pays; two years ago I bought $432 worth of grain and raised 150 bushels of oats; fed three horses, one bull and five hogs, and sold $1,035 worth of butter, and raised six calves; the grain I buy is corn meal, cotton seed meal and bran; cows average 306 pounds per cow this year; cows are grade Jerseys; raise my cream in Stoddard creamery; care of cows is the first thing to consider in getting a good yield from them; milk them ten months in a year; feed grain the year round, bran and meal; cows come in in January and February and are carded every day in winter; know it pays to do so. In

answer to a question by a member of the Board, Mr. King said, I attribute my success more to extra care than extra feed.

M. L. Gilman, one of the meal feeders of that thrifty section of the county where great quantities of meal are fed, sold from 14 cows $800 worth of butter; his meal feed cost $200.

Mr. Hinckley gave his experience in sheep raising, which was interesting and showed this branch of his farming profitable.

NORWICH INSTITUTE.

At the evening session Mr. Davis, of the Board, spoke on "Profitable stock feeding." In the course of his remarks he strongly impressed upon his hearers the importance of first securing the right animal, one that would utilize the food in a proper and profitable manner. The animal is the machine by which we convert the crude material into beef, pork, milk or wool as the case may be, and too much importance cannot be placed upon the machine. Too many farmers are feeding just enough to keep the animal alive. If he adds to that every pound will pay largely to a certain extent. Uniformity in feeding and the condition of the building are not by any means to be overlooked, as the comfort of the animal is as important as the feed. Keep the barns as nearly as possible at the same temperature. Too much of our fodder is fed in the wrong proportion and when fed in an imperfect ration much is lost to the animal.

Mr. Winslow—The first consideration in feeding stock is to get our pay for the fodder eaten by the stock. It is also important to get the right animals for the business we are in. I can tell just how many pounds of milk each cow in my dairy has given the past year. The speaker referred to the importance of farmers learning the capacity of their stock as regards the amount of food they can consume to a profit; also the results of the same. Cows should be tested to know how many pounds of butter each cow will make in a year. When you know your cows perfectly you know how to select intelligibly.

Mr. Vail—I am making butter and using Jerseys to do it with. I have not as yet got my herd as high in product as some of my neighbors. I pay more attention to the raising of pure blooded stock.

FERTILIZATION.

BERLIN INSTITUTE.

Prof. Cooke spoke in the afternoon on the question, "Are commercial fertilizers a failure?" They may be for some things and not for others. If you should run the farm with nothing else and sell the produce it would soon be an utter failure. If near large cities you could afford to put all the farm into a garden and could buy some stable manure and commercial fertilizers, as they do in New Jersey at very good profit. Farmers in Vermont must keep

stock and make more manure. We may need some phosphate, but just what kind on the different soils is what we want to learn. They are used more in Vermont to act as a kind of stimulant, which we can do to a certain degree, and it acts upon the plant as extra feed does to an animal. It is a helper to the natural functions of the soil. The after effect is not from any bad results of the fertilizer, but lack of proper elements in the soil. It must have plant food all the time till the crop is matured. You can raise a crop on nothing but phosphate if it is put on liberally. If the crop does not use it all the first year it will benefit the next year's crop, but I would not advise farmers to buy that which was not soluable the first year. Corn would not use 400 pounds per acre. Potash and phosphoric acid will not leach but nitrogen will and also evaporate. If you put on more than the crop needs you are losing the interest on your money. The vigorous growth of plants caused by phosphate, has this advantage, it has a stronger set of roots and matures sooner and early crops are better than late ones.

The cheapest plant food we can get comes from barn yard manure and the articles fed have a great influence on the value of this. Of grains that we feed there is a great difference in the fertilizing value of the manure made and it is not in any ratio with its feeding value.

Manure contains about 80 per cent. of the fertilizing value the feed contained before feeding, the animal taking only one-fifth of it. If skim milk should be fed to oxen at rest you should get back nearly its full manurial value, but if fed to young growing stock they would take up much more of the value. There is a great waste in all our Vermont farms. If a farmer sells nothing from the farm but butter he sells no fertilizers and the skim milk fed on the farm is a great addition to the manure. Cheese takes away the nitrogen, since curd contains nitrogen equal to 1-6 of its weight. Phosphate of lime is in the whey. All parts of the State are deficient in phosphate. I think the best and surest way to fertilize a farm is through animals, although it takes longer. Butter has no fertilizer value but a high feed value. Ashes are of no feeding value but a very high fertilizing value. Corn meal is rich for feed, but about the same as hay for fertilizing. Clover contains a very high manurial value, much more than corn meal. Corn meal has the least fertilizing value of any of our grains. Oats and barley come next. Bran is not worth as much to feed as corn, but the manure is worth as much again. Bran made by the new process is more valuable both for feeding or fertilizing than the old. Flour is worth less for feed than whole wheat ground. Take away the flour and what is left is better still.

NORWICH INSTITUTE.

Prof. Cooke—Out of the feeding this winter comes the fertilizing material for the coming crop; and we should feed with this idea in view. Different foods have different fertilizing values.

Some are very high and some worth nothing. Clover hay is worth twice as much as timothy for manure. If you are to sell any kind of hay sell timothy and feed the clover. One ton of clover hay is worth, after being fed, for manure, $7.50, timothy hay only $4. Bran is worth more than clover hay, its value being $1 per ton while it costs about $18 per ton. The fertilizer value of oil meal is $17. Gluten meal costs the same as corn meal and is worth more as a feed and three times as much as a fertilizer. Cotton seed meal is of the highest feeding value and also of fertilizing value. In speaking of the fertilizing value of the above it is based upon the commercial price of the elements found in the manure heap after it has been digested by the animal. Cotton seed meal has been used as a manure for corn with good results by putting a handful in the hill; but it would be much better to feed the same as only 20 per cent. of the manurial value is lost in passing through the animal. It is one of the best and cheapest ways of restoring worn out farms to buy concentrated feeds and feed to animals that will pay the cost of the same and leave the fertilizers on the farm free.

FORESTRY.

WEST CONCORD INSTITUTE.

Mr. Chapin spoke on forestry matters. In the course of his remarks he said white ash, black cherry and bass wood are all fast growing trees and make valuable timber. Fencing our farms and wood lots is a great tax amounting to $600,000 a year in Vermont. We know too little about the capacity of our farms. The amount that can be raised on an acre is almost fabulous. He gave as an illustration Mr. Cheever's 26-acre farm on which he kept as many head of cattle. Our lands that are too poor to support Swedes, Irish or Frenchmen had better be allowed to revert to the growth of trees again. Let more grow up to woods and cultivate better the best part.

Judge Hovey said: It is of the most vital importance that we preserve the timber on our poorer lands. Steep hillsides and broken rocky lands can be made more profitable than any other use we can put to them and will pay better interest than the savings bank. It is astounding what rapid growth trees often make in twenty-five years; a spot of ten acres was cleared on my farm, now there are maples over a foot through, and if proper care had been taken, all of them might have been so, and that would have made trees enough for any farm.

FRUITS AND VEGETABLES.

BERLIN INSTITUTE.

The Farmers' Institute for Washington county was held at Berlin, January 22 and 23 under the auspices of the State Board of

Agriculture. At this meeting Deacon E. E. Andrews was chosen chairman. There was a large attendance and more than the usual number of ladies and young people were present. At noon of each day the ladies spread bountiful tables and all sat down to a rich repast. On the whole it was a season of enjoyment from beginning to end. The discussions were to the point and questions very intelligently put.

At the opening session Mr. Davis, of the Board, spoke on "Vermont Staple Crops." In the evening Mr. Andrews of Berlin read a paper on "Fruit Culture."

The speaker said it was a conceded fact that the apple took the front rank among fruits, owing to the uses it can be put to and the wide range of country in which it can be produced. The expense of growing is also small, trees once started were but little care. If planting for market, he would not advise planting too many varieties; but only one or two kinds. Fruit is very much like other crops. It requires a certain amount of cultivation and preparation, but as a general thing fruit is the most neglected crop in Vermont. To prepare the ground for an apple orchard, it should be used for hoed crops at least two years. When the trees are set the hole should be dug large enough to admit the roots without being thrown out of natural condition. The tree should be set three inches deeper than when in the nursery. Sift on dirt that is firm around the roots and when nearly full, put on a pail of water, then cover with more dirt and pack down firmly, banking the tree slightly. Trees should be set about 20x20.

The treatment of pears is similar to that of apples, but I have noticed that pears always develop best when near buildings. Sink drains and raw manure are good fertilizers, but they should not be used too near the trees. Cultivate the soil in young orchards the same as you would hoed crops. Spread manure on the ground further out than the branches extend as the roots extend further than the branches. Wood ashes are an excellent fertilizer for fruit of any kind. The first settlers had no trouble in raising the finest kind of fruit. The soil when first cleared had all the elements for fruit growing. When we learn what the soil needs and apply it, we can raise as good fruit as our fathers.

We can raise grapes successfully but only few varieties. Our greatest drawback is the cold weather. They should be trained on a frame attached to a trellis hinged at the bottom which can be laid down in the fall and covered with straw. The currants take a front rank and have only one enemy which can be easily overcome. All fruits will pay for raising. Strawberries on a plot 20x20 will supply a good sized family. Time spent by many a family in gathering wild ones would bountifully supply the family from the garden.

Prof. Cooke—We in Champlain valley get a better growth in setting apple and pear trees as far as 30x30 feet apart, but perhaps in this high altitude a less distance might do. Any nitrogenous fertilizer produces too large a growth of branches so tender that

winter will kill them back. Ashes contain no nitrogen and fruit does not require any.

Mr. Andrews—I have apple trees 86 years old. I would not graft an old tree but would let them bear natural fruit.

GRAND ISLE INSTITUTE.

Although the morning was not very promising the people came at an early hour, and there was a good deal of activity visible about the premises, getting the exhibits in place. There was a very laudable interest in this matter and in addition to the exhibit of fruits, vegetables, etc., there was a large show of horses, particularly of colts, and a good number of sheep. The first subject for the forenoon was "Fruits and Vegetables," by Mr. C. W. Minott of the State Experiment Station. His remarks applied especially to what has been done at the Station during the past season.

The work is largely testing grains, vegetables and fruits. A large number of varieties of beans, corn, etc., have been under trial. The season has been bad and the results not so satisfactory as they otherwise would have been. The results of the experiments will be included in full in the forthcoming report of the Station, to which all will be referred. Have grown about 120 varieties of field, sweet and ensilage corn. The Giddings variety of field corn is reported as early and desirable for this part of the State. Vermont pedigree corn, perfected by Dr. Hoskins, is recommended as a good variety. It is quite prolific.

Of sweet corn—40 varieties—the "Pride of America," and "No. 48," are early. These two kinds matured in 72 days and were 14 days earlier than the Corey. The LaCrosse is quite early and prolific, averaging 2½ ears to a stalk. The early Dean and Mexican Sweet are desirable kinds.

A large number of apples and berries have been planted, but it is yet too early to give results. Some of the grape vines are commencing to bear. The Wyoming is very early, the fruit being ready for the market by the middle of August.

Mr. Chapin asked as to the best variety of strawberry for our State. The speaker advised trying a kind that is the most successful in his vicinity. He thought for general use for the farmer the old Wilson was the best. Try the newer varieties on a small scale and then judge of the results. The Sharpless is a good berry for the market, but is not very desirable for flavor.

Does not think that blackberries would succeed very well here without protection in winter. Would cover with earth. A late fall growth of the vines should not be encouraged, and they should not be prunned late. The cutting back should be done in spring. Have planted 40 kinds of ensilage corn, of which the result will be found in the report. Twenty-seven tons per acre was the largest amount raised. The kind was the Virginia horse-tooth.

GRASS.

BRADFORD INSTITUTE.

Mr. Chapin's paper on grass, he said in answer to questions, I do not recommend the sowing of alsike as it does not hold out, kills after the first mowing.

Mr. Vail said:—Have sown it some but do not now although I like it well as feed, it kills out too quickly.

Mr. Smith said alsike wants a rich warm soil, knows of pieces of land where it has grown 4 or 5 years in a run between two side hills where it had been sown. It kills out on dry land, and does well on moist heavy lands.

Mr. Vail said: Orchard grass grows a heavy crop, but must be cut early to be good fodder.

Mr. Chapin said: Consider alsike a valuable fodder for the dairy.

Mr. Chamberlin said: My cow dropped off after feeding it, preferred clover for a feed.

Mr. Chapin said: The nature of every plant is to seed and reproduce its kind. When it has done that it usually dies. Clover and grasses if cut before they seed will sprout up and produce another crop. We sow anything we can buy but prefer the medium.

Mr. Golding said: I pasture my mowings; used to think it was injurious, but I cut as much hay as ever. It is injurious to leave too much aftermath on our river meadows and have them covered with water. Ashes are valuable on any farm for either grain or grass, better then phosphates.

Mr. Peckett, of Bradford, said: Farming, on the whole, conducted with the same economy is as good as any other business; trouble commenced when gold was worth $2.60 in 1862. People thought it would always be so; farmers became extravagant; bought their corn because it was cheaper than they could raise it; a suicidal idea, we can raise any crop cheaper than we can buy; can raise wheat as well now as ten years ago, fifty years ago I was a clerk in a store here and we used to pay 10 cents for butter, 23 for wool, 50 for corn, $1 for wheat and the farmers' supplies were much higher then than now. People did not complain of hard times then—why need they now if they used the same economy? Too often farmers do not sell the produce when they should; know of a farmer in this town who has just sold a number of crops of wool for 22 cents some of which he refused 40 cents for. Keeping farm crops is likely to result in more or less shrinkage and loss.

I claim that Bradford should raise every bushel of the corn it consumes and they buy 30,000 bushels at the depot every year. Farming is the foundation of all other industries and must be fostered. Raise everything that you need that your farm will produce.

BENSON INSTITUTE.

E. L. Barber, of Benson, spoke on cutting and curing of hay. Neither cotton or corn is king of Vermont. The time was when sheep was the prominent industry. The horse has been looked upon with much favor. No portion of Vermont produces better grass than the western Vermont. Many of our meadows have never been touched by the plowshare and grow grass spontaneously. This crop can be truly be said to be king of Vermont. Fifty years ago farmers did not begin to cut their hay till the first of August, and did not finish till September. An old neighbor now living, nearly 100 years old, who at that early day cut his hay three times a year, always had the fattest stock and sold them at the highest prices. Even at that early day his example was worth following. I can fatten cows in eight or ten weeks from early cut hay. It is not necessary to tell a dairyman that fat cows will make better butter than the same animals when poor. The earlier grass is cut the better it is for hay. I would prefer to have it cut early in June if practicable, but it is practicable to cut it before it blossoms. The pollen does not make the dust in our hay. The best hay is made in cocks. More hay dries too much than too little. I would put in as much in a mow as possible. In answer to questions Mr. Barber said; I would prefer hay cut early for cows but not for horses.

Mr. Davis, of the Board—The highest nutritive ratio is nearest to perfection, as it grows older the ratio changes, nothing lost but the ratio changes. I want clover cut very early, if it shows signs of lodging cut it. Cut early and often is what we should do.

Mr. Vail—I am glad to hear of early cutting of hay. A milk man who put all his hay into one mow and cut that in sections, and found his cows increase from top of mow down, and when he went back to the top would get a shrinkage. There is a point after the plant blossoms that contains the most nutritive elements but the ratio is too wide.

Mr. Barber—Grass cut green will sprout again, but timothy cut after seeding will not sprout again.

Mr. Shendon—We in this part of the country seldom cut a second crop of timothy and if we cut too early we get too small a quantity.

Mr. Davis—Sell less hay and feed more. Your farms are growing poor the more you sell.

Mr. Vail—I am obliged to cut some sooner than I want to in order not to have any suffer.

BERLIN INSTITUTE.

A question—Shall we mow our rowen or feed it off? Difference of opinion came from different parts of the State. Mr. Chapin said never to turn any stock on the mowings. The pulling up of the grass impairs the roots, and the stamping of the ground kills many

of them. Much better to put cattle into the barn and mow grass for them, than to feed it off.

Mr. Currier said: I have doubled my hay crop in 12 years; never turn stock of any kind on the mowings; either mow it, or let it rot on the ground.

Mr. Smith said: I feed my meadows, but do not feed after mowing the second crop. The mowing of the second crop and feeding the third is very injurious. I can get much more milk by letting the cows feed off the grass, than by cutting it and feeding in the barn. There is a proper way to use land, and it should not be pastured too close. When the milk shortens take out your cows; of course feeding too close will injure it. That farming is a good business is apparent, or there would be many more failures than there are now. Farming is a trade, and should be as systematic as any other business.

C. M. Winslow, of Brandon, said: Farm in different parts of the State demand different treatment. Very productive, natural grass lands can be fed in the fall with no injury—in fact, it is much better to feed off the grass than to let it remain on the ground and smother the roots. Farmers must learn of each other in their own immediate vicinity. What would be advisable in one section would not be in another. Farmers should put more system into their business. If merchants transacted their business in as slipshod a manner as a large portion of farmers do, they would all fail.

GRAND ISLE INSTITUTE.

The next subject, "Grass is King," was taken up by Mr. Chapin. Vermont is particularly adapted to the production of grass, and whatever tends to its improvement is worthy of attention. About four-fifths of our cleared land is devoted to the growth of grass. The value of our grass and hay products approximates $14,000,000 per annum. How shall we keep up the fertility of our grass fields? Manuring liberally, reseeding whenever needed, and not pasturing mowings by stock. Draining wet places is of much importance. Having clean fields, free from obstructions and useless fences, will add to the yield of hay, and the facility for harvesting it.

When the crop of hay gets to be small, plow up and plant to corn, one of our best crops, manure well, and seed again to grass. Fifteen pounds of timothy and ten of red clover he finds best for this purpose. Sow with or without a grain crop, as it is thought best.

Orchard grass may be found excellent in some locations, but does not succeed well everywhere. Would cut grass early, and get two crops in a season if possible.

Advised taking care of the pastures or letting them grow up to timber. Cut up the bushes, sow on grass seed where necessary, and improve by all possible means.

ROYALTON INSTITUTE.

Nathan Parker said: I make a practice of sowing my grass seed with my corn at the second time of hoeing. Plant my corn 3½x3½. Do not hill it up. Rake in the seed with a hand rake. Sow it when the corn is from six to eighteen inches high.

Mr. Riford said: I sow grass seed about the first of August in my corn. The corn at that time is as tall as it ever will be. I use a slanting tooth cultivator; keep the land level. Think corn will yield about 125 bushels of ears to the acre. Stook my corn on the field. It does not kill the seeding.

Mr. Storrs, of Randolph, in answer to questions said: I seed my fields with corn at second hoeing; prefer to do it about the time the corn tassels; use a Planet, Jr., cultivator; plant with a horse planter; when I sow grass seed with corn use a cultivator made like a Thomas smoothing harrow; sow the seed by hand; can sow it evenly if I go through every row; use a mixture of timothy, red clover and alsike; the latter does not do as well on dry lands as on moist; think by sowing with corn get better crops of hay than otherwise; always get two crops the first year after sowing; think the grass hinders the ripening of the corn somewhat; my corn yields about 100 bushels of ears per acre; think in the two crops I cut four or five tons per acre; prefer early cut hay for milch cows; cut second crop in September; feed my meadows; keep fifty head of cattle, and mow over about 30 acres.

WOODSTOCK INSTITUTE.

Mr. Chapin, of the Board, read his paper on grasses. The best grasses for Vermont are the herdsgrass and red clover, though orchard grass grows rapidly and luxuriantly, makes very good feed for sheep and cows, not so good for horses, and if cut at just the right season the first time three crops may be had. But it must be cut the latter part of June before it is seeded. The meadows should be top-dressed, about ten loads to the acre, and occasionally turned over. In seeding do not sow a heavy crop of grain. Seeding should be done in the spring, which is nature's time for starting new seed. Do not turn the stock into the meadows, to pull up the tender roots and cut the sod. This is particularly important where the field is newly seeded. In any case, far the better way is to supply at the barn what is needed beyond the pasture feed. Enlarge the meadows, and the crop, and the profit and the reputation of the farm, by removing unnecessary fences, with their attendant rod wide of briers, bushes, stones, etc. Clean out of the mowing the trees and stumps and stones, so as to increase the area for the use of machinery. It ought not to cost over two dollars a ton to secure the crop. Counting taxes, interest on the investment, and all other expenses, the grass crop costs to average about five dollars per ton, and it is the most important crop Vermont has.

BENNINGTON INSTITUTE.

The able address by William Chapin, of Middlesex, was well received by a good audience. He began by saying that "Vermont is a State of farmers and farms." This is as true now as it was when the first permanent settlements were made at the close of the French and Indian war. He referred to our early history, to the Connecticut yeomenry who came up to find farms and make for themselves a home amid the beautiful valleys and fertile hills and mountains of our State. They came to bring civilization with all its wealth of blessings, where before had been a howling wilderness. They built roads and bridges, schools and churches; aye, better than all, they built, and maintained and defended one of the best State governments the world has ever known. Truly, "there were giants in those days," not only of form, but of mental stature. The speaker delighted his hearers with the recital of Jerry Eastman's eulogy on Vermont. He then followed with an interesting sketch of the early history of Vermont, which has been so often referred to in connection with the building of the Battle Monument. We have not space for his sketch of Ethan Allen, "who died as he had lived, a farmer." Col. Seth Warner, the compatriot of Stark and Allen, was also a farmer. Remember Baker, who was always included with Allen and Warner in the rewards offered by the State of New York for capture as rebels, was a farmer likewise. He traced the settlement of the State and paid this tribute to the first President of the Council of Safety, the father of the State, the Hon. Thomas Chittenden, that "what Washington was to the whole country, Gov. Chittenden was to the State of Vermont." The Central railroad passes through the old Chittenden farm in Williston, in sight of the old house.

Other prominent examples were cited of the farmers of the olden times: What of the present? What shall we say of the men and women of this present generation who have inherited the farms and taken the places of those that are gone? Better fed, better clothed, and with a thousand advantages which the fathers did not possess, have the present occupants of the soil made a corresponding advance in the dignity of farm life?

He then proceeded to ask other pertinent questions, and then said, I do not come here to run down the class and generation to which I belong, neither have I come with flattery to say that we are all the salt of the earth—take that sort of talk with as much discount as you would want these days on a Western farm mortgage. The fact is, ladies and gentlemen, the times are a little out of joint for the farming class, and the sooner we realize and face the fact the better it will be for all concerned.

He named some of these facts as (a) the legacy inherited from the civil war, with the rebound in values following, while the extravagant habits and modes of living were kept up; (b) the wish to become rich; (c) a monied cod-fish aristocracy; (d) unequal taxation, and oppressive rates of transportation; (e)

humbug investment and insurance companies, including counterfeit butter; (f) great monopolies and trusts of all kinds; (g) a swarm of high salaried State and Federal officials—these will do for a sample of the whole, be the same more or less. And the burden of maintaining all this laziness and wickedness comes upon the tillers of the soil. The farmer finds them all. What wonder that "we do inwardly groan, being burdened." What wonder our farms are abandoned, deserted or neglected, so that we have to offer premiums to get foreign immigrants to settle on our soil. [The speaker forgot to add that these immigrants are only asked to stop and take the places of Vermont farmers going West.] Is it not time that we, as intelligent farmers, studied the cause, the consequences and remedy for these evils? The speaker quoted from the Providence *Journal* an article, as to the remedy: (1) Farmers should take a more active part in political and civil affairs. In this way taxation will be equalized through the influence farmers may exert in the Legislature. (2) What about Vermont farms, the so-called abandoned lands, which comprise about four per cent. of our farm lands? Those on high and rocky hills should never be reclaimed, but let us encourage the re-settlement of all that are fit for families to live upon, either by our own children, or by immigrants from other lands; the Swedes, Norwegians, Danes, Scotch, and some others. These make good citizens; let them come, there is room enough, but be sure to save all the old Puritan stock, and increase it by all lawful means.

Our occupied farms are growing in productiveness and value. In spite of our relative loss in population, scarcity of farm help, and other discouragements, the farms of Vermont hold out nobly in the value of their productions. In cattle, sheep, horses, and swine, we are well up with other States of the Union according to our area. In the yield of grain per acre we are far ahead of the average. Fifty-six per cent. of Vermont lands are productive, and twenty-five per cent. is woodland, while the average of the whole United States is only 15 per cent. productive and 10 per cent. woodland. Of our farm lands 28 per cent. is tillage, 30 per cent. grass lands, 31 per cent. woodland, with less than two per cent. waste lands. In yield of corn, per acre, Vermont stands at the head, and in the yield of oats she stands third in the Union. In wheat only a few of the States equal us in the yield per acre, and those are the Rocky Mountain States and Territories where only the best of the land is settled. The actual money value of production per acre in Vermont exceeds that of most of the States, according to the "Album of Agricultural Statisties," issued by the Secretary of Agriculture, June 10th, 1889, based on the average of ten years. Our farms that have been taken care of are as valuable as they ever were. I have traveled through the West and Northwest and South, and except a few sections of New York, Pennsylvania, New Jersey and Maryland, and I have seen no better land than Vermont.

This splendid tribute to the State of Vermont, and summary of

its resources and agricultural possibilities, was received with applause, as it deserved.

HORSES.

COVENTRY INSTITUTE.

At the evening session Mr. Winslow spoke about horses.—What are the demands of the day for horses? Vermont has a reputation for producing gentlemen's drivers. Large Western horses are not what is in demand here. Large horses are better adapted for the West than here. Our country is peculiarly adapted to produce a fine driving animal. Our horses are the most intelligent horses in the world. The Clyde, Percheron and Shetland pony are breeds peculiar to themselves, but the Vermont trotting horse is not, he is a mixture. The right kind of a horse for us to raise is the horse that will weigh from 950 to 1,100. The French coach horse may perhaps be just what we may want. They look very much like our Morgans, but will probably lack the courage of the Morgan.

Mr. Williams.—Morgan horses were at one time bred too small. Those smaller Morgans were not so well adapted to farm work but they were sought after as gentlemen's drivers, and commanded a large price. We should breed for gentlemen's drivers from 15 hands to 16 hands high, and should not breed entirely for speed. If we want to breed for speed alone we should breed Hambletonians. Pure horses of this breed are not what we want here, but the Morgan horse, if of good size and good style, is always saleable. The supply has never been up to the demand and the more speed they have the more they will bring. The majority of our Morgans, as bred to-day, are good workers and valuable for all purposes.

Mr. Davis—Vermont has the right seed for securing the perfect horse, only it is too small. Why can not they be increased in size the same as the race of Durham and Holstein cattle were originated? Feed better and raise better and you will increase the size. The Prince of Wales sent to Vermont for horses, and none other than Vermont horses would answer.

Mr. Williams—I would sooner feed four quarts of oats the first two seasons and then if obliged to feed short do it afterwards. Never feed a weanling short, but keep them going. If stunted, they never recover from it.

DORSET INSTITUTE.

Mr. Winslow, of the Board, was the next speaker. His subject was "The trotting horse on the farm." Prominent among the heavy draft horses are the Clyde, Shire, Percheron and Norman. The Clyde and Shire are virtually the same horse, being bred in different sections of country; also the Percheron and Nor-

man. Are these breeds profitable in Vermont? We farmers have a good deal of road work and can hardly afford to keep a horse that is not fit for driving. Always raise the highest type of any animal. In the Western States with their cheap feeds they can raise these heavy horses much more cheaply than we can. The French coach horses as well as the English are always in demand. I do not think the Cleveland Bays thorough-bred horses. They have not the strength of prepotency to reproduce their kind as a thoroughbred has. The French coach appears to be a typical Morgan, only larger, with perhaps less vim and speed. The smaller ones are fine cavalry horses, while the larger are valuable for coaches.

An intelligent Western horse breeder says Vermont made a great mistake in letting the Morgan go. She would have stood at the head of all the horse breeding countries in the world had she kept the Morgan blood as pure as it was 30 years ago, and improved a little on the size. The Morgan horse, with proper feed and breeding, could be grown larger and still preserve the characteristics of the breed. I do not consider the general purpose horse of Vermont a thoroughbred animal.

Old Justin Morgan was a horse about 14½ hands and weighed about 950 pounds. He was a wonderfully strong horse, and was often put to the test of drawing a heavy load, and also of trotting and running.

Gray Messenger was also a very powerful horse, and from him have been raised our Hambletonians. Their crosses with the Morgans make our best horses.

I would not advise farmers to breed solely for trotters. Good horses, weighing from 950 to 1,050 pounds, about 15½ hands high with good speed will always sell. It does not hurt them to do the ordinary farm work, and they can do the family driving. Such horses are too much drained out of the country, but we have some left.

No farmer handles a colt without knowing something of his powers. You can not afford to hire him trained. Good single drivers and matched drivers always find a home market. There is no cost in trying to market them. The buyer will find the animal. The trotters of California and Kentucky are strongly impregnated with Vermont Morgan blood, and we have sold too many of our best breeders. Breed from the best, and our State can furnish the ideal horse of the world.

EAST FAIRFIELD INSTITUTE.

Mr. C. M. Winslow, of Brandon, a member of the Board, next gave a lecture on the raising of horses. He was of the opinion that farmers might well pay more attention to the raising of good horses. Perhaps it would not be best to engage too largely in this business, but farmers raising horses might with careful management raise one or more each year.

If this business is engaged in, it would be well to breed those that are in the best demand and will command remunerative prices.

We are in favor of a kind particularly adapted as carriage or driving horses. We have excellent strains of blood in the Morgans and Hambletonians. Far too many of our best horses have been taken out of the State, but still we have many good ones left.

Our Vermont bred horses will last twice as long for real service when taken to the cities as will those coming from the West.

Would not pay too much attention to trotting stock, but still good action and style are to be sought after in selecting and breeding. Carriage horses weighing about 1,100 pounds are in good demand at most times. These horses will answer for the road or the farm.

Would not recommend a farmer to develop a horse for speed; let some one else do this. Considered it always best to sell a horse or colt, if not wanted on the farm, when a fair price can be obtained. The younger a horse can be sold satisfactorily, the more profit will be realized. By all means do not be a horse jockey; this is not legitimate farming.

In the breeding of horses always select animals of good disposition, sound and kind. At the close of the lecture the speaker answered many questions from the farmers. Would feed a weaned colt the first winter oats and bran, with good hay. Has fed two quarts each per day. After the first winter does not feed grain until time to work. Can raise a colt as cheaply as a steer. Keep in a warm box stall. Two colts may run in a room of sufficient size. Always keep them growing and thrifty. Would feed a horse three times a day. Has them well broken at three years old, but would not work them very hard at this age. Personally prefers the Morgan and thinks there are none superior to this breed for his purpose.

GRAND ISLE INSTITUTE.

Mr. Winslow next gave an elaborate address on the "Breeding of Horses." He made a statement at the commencement that is of the most sterling worth. It was that all engaged in the business of breeding and disposing of horses should be thoroughly honest. This would save much trouble often experienced from the practice of trickery and dishonesty. He laid great stress on breeding for a purpose and using the best kind of stock, not the first that comes to hand or costs the least. Would advise the raising of the kinds of horses for which there is the greatest demand and for which a reasonable price can be obtained. He gave a description of some of the best and most popular breeds and those he considered the best for Vermont farmers to raise.

There is and doubtless will continue to be a steady demand for good horses. It was plain to be seen before the close of the address that the speaker favored the Morgans as a breed of horses that will give excellent satisfaction in most places. If a farmer happens to raise a colt that gives a promise of speed, he advised

him to get rid of it as soon as a fair price can be obtained, as the breeding and developing of speed are distinct, and the latter belongs to the professional trainer and not the farmer. He spoke of the importance of good care and feed of colts while growing, as this is more necessary then than afterward.

Colts liberally fed should have plenty of exercise, for if kept close it will be worse than stinting in feed. At the close of the address remarks were made by those present. Mr. Phelps, of South Hero, spoke of the importance of having a ground floor with a good dry bed for the benefit of the feet and legs of horses and colts.

ROYALTON INSTITUTE

D. W. Bliss, of Royalton read a most interesting paper on the Morgan horse. The past year is the centennial of the old Justin Morgan. Had he lived would have been 100 years old; was brought to the town of Randolph in 1791; was sired by True Britton and he by Traveler. Justin Morgan was the sire of the celebrated Sherman, Woodbury and Bulrush Morgan. The Lamberts are direct descendants of Sherman.

WEST CONCORD INSTITUTE.

Mr. Winslow remarked that the soil, climate and feed of Vermont are peculiarly adapted for raising any kind of live stock and particularly horses. Vermont horses are noted all over the United States for endurance and docility and are much longer lived than Western horses. He believed in mixed farming. Do not put your eggs all in one basket. Horses can be raised on the farm with very little extra expense. Every farmer should at least raise his own horses. The market is always good for good drivers, and doing farm work does not injure them for that. There is always a market at home for them. The buyers will come to your own doors. Should raise the horse that people will want to buy. Sell your horses on their home merits, and do not send them away for a jockey to train. Should breed as much for disposition as for style or color. Would begin to break a colt when a day old, by catching and holding him and continue this for a week or two. The colt will never forget it. Vermont horses are apt to be undersized. This can be remedied very much by better feeding. Don't let a colt stop growing when being weaned. Feed liberally with oats and bran; even skim milk is good. Always give plenty of exercise.

Mr. Cheney, said: During the war I had occasion to see horses from all over the State and was always proud to notice the pluck and endurance of the little Vermont horse. We had horses from four different States in our Vermont battery and the little Vermont horse was always in the best condition and endured the hardships better than any other.

Mr. Quimby, said: The reason why the Vermont horses last

so long is because they are not matured so young as western horses.

Mr. Winslow, said: The best crosses for all purposes are the Morgan with the Hambletonians; two crosses of Morgan with one of Hambletonian. Think soil and climate have much to do with the endurance of any animal.

WOODSTOCK INSTITUTE.

Mr. Winslow, of the Board, spoke on Morgan horses. Before engaging in breeding it is well to see what horse is best adapted to the country. Some to serve selfish purposes will advocate Percherons for these hills, but while they are admirable for the western plains they are out of place here. From Canada and Northern Vermont come strains of the English thoroughbred. Justin Morgan, who has done more than any other horse to benefit Vermont, is believed to come on one side from that stock. In his time he was the champion trotter, runner and puller. Kentucky takes all her fame to herself yet she came to Vermont to get Morgan mares from which to breed. Maine too acquired fame through the Knox horse which she imported from Vermont. The demand to-day is for gentlemen's drivers that will weigh 975 to 1,050 pounds and measure 15 to 15.3 high, with intelligence, good style and action. Such horses will do the work of the farm and always find a ready market at good prices. Begin training young. Handle the colt, take him in your arms and teach him that you are the strongest. Feed oats when taken from the mare but give plenty of exercise. It will cost no more to raise a colt to three years old than it does a steer, but they will sell for a far greater price. Beware of the jockeys and don't undertake to train a horse for the track. That isn't a farmer's business and he will fail if he undertakes it. Sell when you can get a fair profit and let some one else do the fitting up, and take its risks.

MAPLE SUGAR.

JOHNSON INSTITUTE.

Mr. Harmon Morse, an elderly gentleman, gave his experience in sugar making as follows; My first recollection of sugar making was to help load a potash kettle on an ox sled and draw it to the woods where it was hung some five feet from the ground by balancing the tree across a stump by which means the kettle could be carried to or from the fire as the case demanded. This kettle was banked by logs on four sides and the fire made in the corners. For storage they used molasses hogsheads cut in two in the middle. We caught the sap in basswood troughs. Next we had pine buckets with the head in the wrong end, viz.: the larger one, and when we got the Russian iron pan we thought we had reached the limit of improvement in sugar making. We finally changed

the head of our buckets from the large to the small end. This enabled them to be transported with much less labor.

I found in using the pan that we were apt to boil too long which colors the sugar. If sap could be evaporated without heat the sugar would be white as snow. The sugar in sap is a complete solution and the main study should be to get the sugar out of the sap with the least color possible. I think there is a constant burning all the time the sap is boiling. I would not boil sap more than four hours. Freezing sap leaves the finest syrup I ever tasted. The theory of the evaporators making white sugar is that you feed an evaporator at the hottest part of the pan and as it grows sweet it moves farther from the heat. The quicker sap is boiled down after coming from the tree the better. I use a three-eighths bit to tap my trees. A tree will run the most sap on the side where it has the coarsest bark. A tree that leans will run the most sap if tapped on the lower side. A small part of earth can produce maple sugar and it will always be a luxury.

WESTMINSTER INSTITUTE.

Mr. Cutting was called for and spoke on maple sugar. A western experience in his own life had convinced him that it would be wise to have the sugar industry explained more fully in all its details for the education of the public. He had handled Westminster sugar in the West that people were suspicious of because it was so nice. They thought it must be adulterated. There was a too prevalent feeling of distrust against the integrity of farmers. People thought farmers always put the best apples on top, and this lack of confidence was certainly a serious obstacle to farmers.

WEST CONCORD INSTITUTE.

Talking of sugar making, J. Hovey, said: I use in making, an evaporator, think it makes a better article than pans. Cooling and heating increases the color of the sugar. The best sugar never gets cold from the time it first heats till finished. I much prefer tin buckets to wood; the latter are porus and get sour;

Willard Chase, said: The earlier settlers cut trees where they could get them easiest, I have now 600 trees on six acres large enough to tap, which have grown since I can recollect. Have 2,000 on one lot where grain was once raised. Would advise keeping cattle out of sugar works. Trim with an axe; use a ⅜-inch bit with a tin spout; am compelled to use wooden buckets, don't want them painted inside. Tin late in the season will draw more flies than wood. I use balsam spouts to convey sap from one part of the woods to the boiling place. Woods are on the northeast side hill; boil with pans and heater; think should prefer a tin evaporator to an iron one, do not want the sap over two inches deep in the pan; use no ice; syrup off as often as you can, and wash often, market in tin pails.

PIG FEEDING.

PLAINFIELD INSTITUTE.

Prof. Cooke told about feeding hogs at the Experiment Station: Hogs are accessory to the dairy. Pigs and calves are the only stock we can feed the skim milk to with profit. We purchased six pigs May 14 and closed the experiment November 11. We gave each the same food while they were of the same weight; at first only skim milk was given, and as they advanced two ounces of corn meal was added to each quart of skim milk; bran was added later and no other feed was given them. No grain was given them till they weighed from 40 to 50 pounds. They weighed when purchased from 14½ to 27½ pounds each. It is possible to feed pigs to produce either fat or lean meat. The element in sow's milk is largely to produce bone and muscle. Skim milk and bran are good muscle-producing foods. The market in Europe demands a class of pork that has much lean meat in it. Canada feeds grain that will produce it. It is difficult to make a pig of less than 50 pounds weight gain a pound a day. After that size, to about 200 pounds can easily make them grow more than that. These pigs averaged on whole test a gain of a trifle more than a pound per day. The gain of these pigs was the same as if one pig was kept 1,012 days and gained 1,088 pounds. The highest grain feed was three pounds corn meal, one and one-half pounds of bran, six quarts of skim milk. Rating the skim milk at 15 cents per hundred pounds, the cost will be as follows:

5582 pounds skim milk at 15 cents	$ 8.37
1224 pounds corn meal at 90 cents	11.01
844 pounds bran at 80 cents	9.75
	$26.13

Or two and two-fifths cents per pound live weight. By selling them at the market price the skim milk actually netted 24 cents per 100 pounds.

In answer to questions Prof. Cooke said: It does not make the food any more digestible to cook it. Experiments made in feeding are much in favor of the raw material.

Mr. Gale, said: I feed my pigs skim milk and scalded bran and meal with good results.

Mr. Pike, said: I feed cooked food and some sugar. Johnny cake as made for the table, with sugar added, is an excellent thing for young pigs; have got them as large as 375 pounds at 8 months old; wintered six pigs last winter; fed them $25 worth of meal, scalded, and sold them for $65. Am very much in favor of cooked food and sugar.

ROYALTON INSTITUTE.

In answer to questions, Prof. Cooke gave the following answers: If we were to take the statistics of the State on pork raising we

should find it was unprofitable, but if the hogs were killed when younger it might be made profitable. The cost of making a pound of pork from a young pig is less than half as much as when it will weigh 200 pounds. About 180 pounds live weight is the most profitable time to kill. The markets demand a different hog than they did twenty years ago. They want hogs with more lean meat. The demand for that kind of pork is increasing and in England is enormous. Regarding the fertilizing value of feeds Mr. Cooke rated skim-milk at $2.25 per ton, corn meal at $6 and wheat bran at $13.50. The difference between the live and dead weight was 18 per cent. on the 200 pound pig killed at the Station. Unless I had a good clover patch I should not raise pigs for market. Pigs take more food in winter than in summer; must be kept warm in winter.

Mr. Chapin said: The individuality of the pig has something to do with it. The breed must be predisposed to take on fat; clover is a most excellent feed for pigs.

POTATOES.

NEWPORT INSTITUTE.

Mr True, of Newport, was called upon to speak and said that profitable farming depended on what kind of a farm the man has, and what kind of a man the farm has—a well-known fact well put. He had farmed somewhat as a specialist; at one time he ran a milk farm, at one time merino sheep, at the present he is raising potatoes. The farmer specialist should be well posted in his specialties. Mr. True spoke of his last year's crop of potatoes. He is probably the largest potato raiser in the county, if not in the State. Last season he raised 60 acres. His land is light sandy loam. He does all his work by machinery, plows early, harrows very thoroughly, plants by a machine, drops cut potatoes, one piece in a hill, 13 inches apart, covers four inches deep, puts his rows six to a rod. His planter drops the fertilizer as it drops the potatoes. He uses little manure but in its stead uses 1,000 pounds of Stockbridge fertilizer to the acre. He plants as early as possible to put potatoes in. He harrows length-ways of the rows until the potatoes are 4 inches high, and plans to kill the weeds before they come up. He cultivates between the rows, but uses no hoe in killing weeds. His potatoes were practically free from weeds last year. He digs with a machine, draws to the cars as fast as dug and markets at once. Last year his first planted crop yielded at the rate of 250 bushels upward; but the rust struck and killed his vines early and the whole piece averaged only 150 bushels to the acre. Sold on an average at 50 cents a bushel; uses phosphates and plants potatoes right along on the same ground. Bugs were killed by Paris green. Had a barrel on a pair of wheels and two sprinkling nozzles that poured the water

on the rows as the horses drew the machine. Mr. True knows of no way to get rid of this pest except by the common method of poisoning.

Mr. Root, of Craftsbury, said: The very wet weather ruined the potatoes in our town, but the grass crop was heavy.

SHEEP.

BENNINGTON INSTITUTE.

Mr. C. M. Winslow, of Brandon, member of the Board. Every farmer should have some specialty, but keep other branches along. Do not think it best to put all the eggs into one basket. Too many farmers are apt to change stock, viz.: buy when high, and sell when low.

Dairy farms should keep *some* sheep. There are some kinds of hay well adapted to sheep that is not good for cows. Most farmers can handle as many cows with a few sheep as without them.

Sheep should be kept dry, but mutton sheep do not need to be kept warm; comfortable sheds with open doors, they will do better. If housed too closely it weakens them, and destroys the vitality. Merino sheep must be kept dry and warm. Do not think a few sheep would improve the pasture for cows. I want a good growth of feed for the dairy cow. A cow needs more time to rest than to hunt for feed. If she is going to do her best she must not work much to get her supply. Merino sheep will seek the high pastures, and Cotswolds the low ground. If you select a flock of sheep get a kind that is suited to your pasture.

A man must have a natural love for the stock he is trying to raise, if he expects to be successful. He will not be successful in any stock without that. If he does not, stock will not thrive under his management. Many years ago the sheep were grade merinos, and wintered at stack and sheds. Our first general importations were from Spain. Australia and South America are at present our best market for sheep. Vermont sheep taken there degenerate; wool becomes dryer and lighter, and Vermont is the best place in the world to get sheep to increase the quality and quantity of their staple. They need the most intense merino to produce on their native sheep a cross which will be valuable for them. The demand will always be limited.

In order to secure the best prices for this peculiar type of sheep, they must be bred and raised with the utmost care. Sheep of this intense merino type have not as much strength and vitality as those bred for other purposes. The Vermont merino, in many intances, has been bred too much for wool, and not enough for size and constitution. Sheep may be divided into two general classes, those for mutton and those for wool. The mutton variety have been bred for mutton only; they will grow a large lamb in a short time. Merino mutton is of a slower growth. Lambs from mutton

sheep always sell well. My coarse lambs sold for seven cents per pound. Mutton sheep do not flock as well as the merinos. Do not like a sheep of any breed that has its wool part on its back; the storms wet them more. The Downs and Gray-faced Cotswolds have a firm wool. Think the Downs are a tougher and more quiet sheep than the Cotswolds. There is no better mutton than the South Downs. Next comes Shorpshire. For the food consumed can get as large a profit from the South Downs as any. The horned Dorset are a new breed of mutton sheep. We know very little about them here; said to be great milkers, and to produce two and three lambs at a birth, twice a year. They are a very vigorous sheep, but do not think they will take the place of our Downs or Shorpshire. Shorpshire have a longer wool and coarser meat than South Downs.

Fattening lambs for the market has always been a good business. They are taken to market when twelve months old, and probably sold to the consumer for spring lambs. One farmer in Massachusetts feeds 1,000 every winter, and makes a good profit on it.

But I do not think it best to sacrifice the reputation we once had for sheep raising. If our tariff laws were carried out we could raise sheep now. There is a place for fine merino wool that no other breed can supply. We can raise a class of sheep that will make good mutton, and still keep the merino style of wool. We can keep and breed only large, wooly merino ewes, that will weigh 100 pounds. Do not believe in crossing the mutton breeds with the merino, but by breeding can increase the size of the merino sheep, breed off the wrinkles, get a long staple of wool, and use only a large, smooth, long-wooled, heavy ram. Such sheep are to-day demanded in the West. Such sheep will produce a lage fleece of fine wool, and the wethers will make a first-class mutton. Mutton is growing into favor to-day, both in this country and in England. The West produces beef so cheaply we cannot compete with them, but we can with mutton. Beef needs to be kept a few days after killing, but mutton should be eaten as soon as killed. It cannot be transported any great distance. We never need fear the importation of dressed mutton. If the farmers should devote more attention to a mutton breed of merinos, it would be the beginning of a day of prosperity to us.

Rev. Mr. Severance: I was raised on a farm in Addison county, and my father kept 1,000 sheep. The purpose in a man's mind will determine the character of a flock. The idea of sheep raisers in early days was to raise fine wool. The Saxony sheep were introduced; they were very tender. Can remember very well when the question under discussion with the farmers was, whether we should take the French or Spanish merinos to improve the flocks. The Spanish came to the front, and the idea prevailed in too large an extent of trying to get the largest amount of wool from the smallest space. They should have been bred more for size and constitution. Should breed a large sheep that can produce either wool or mutton. I apprehend that California and Texas

will have to come to Vermont for their stock rams. We can breed any sheep we want in this country. Talking with W. R. Sanford, one of the fathers of the sheep industry in Vermont, he says we can breed any way we choose, if we do it intelligently. Too few of us have studied the idea as carefully as we should. Some farmers breed up to a very good sheep, and by some injudicious cross spoil the whole.

I have traveled in Europe and noticed the difference in the taste of different people. English want beef and the Scotch want mutton. The best mutton I ever ate was in Scotland. Any man who has once tasted mutton in Scotland will want it in Vermont. I do not think it would be wise for farmers outside of Addison county to try to raise this intense merino sheep that is wanted in Australia or South America. The demand is limited, and Addison county is the headquarters for that class of sheep.

Mr. Winslow, in answer to a question: The first cross between a South Down ram and a merino ewe makes a good mutton lamb, but they are not good to breed from. I have very little faith in cross-bred stock of any kind.

Mr. Chapin: I keep a few coarse sheep and make them pay. Wool tariff does not bother me any; could make them pay if they did not shear any wool.

Major Valentine: The interest of the wool grower and manufacturer are identical. We want a higher price for wool, and the business of manufacturing correspondingly increases. If there was no wool raised in the United States the price would immediately advance. Wool that is imported as waste at a duty of 10 per cent. should, in many instances, pay 30 per cent. Beef and mutton usually follow each other in price. Now mutton is taking a great advance of beef.

In answer to a question, Mr. Valentine said: The manufacturer makes more money when wool is high, than when low.

FRANKLIN INSTITUTE.

Mr. Winslow, of the Board, from Brandon, spoke upon the subject of "Sheep Raising." He said that although this is specially a dairy region, yet he thought from present conditions it might be well to pay a little attention to sheep husbandry, as it would be more likely to be more remunerative than all cows. The climate, soil, etc., of Vermont are well adapted to the keeping of sheep. Perhaps for this reason it has been found necessary to send to this State from Australia and some other places for breeding stock, in order to keep their flocks from deteriorating in the quality of wool. These were of the merino, a breed bred principally for wool. Would not advise persons without experience or particular liking for the merinos to raise this breed, as they would not be likely to succeed as with some of the long or middle-wooled breeds that produce fine lambs for the market.

A small flock of these sheep on the farm will usually be found to be profitable. They are good renovators of the soil. At

present prices for wool, does not think it would pay to keep the merinos; with a higher protective tariff the prices would be higher and the prospect for this breed better. A breed of sheep that will give both good mutton, and wool will be found the most profitable, as the lambs will always sell at good prices, and the wool will bring something. If he can realize five or six dollars a head for ewes, for wool and lambs, is well satisfied. Sheep require much less care than cows.

Would advise farmers to be careful in making changes of stock. Make changes gradually and not too often. He thought it well for farmers to engage in a more general system of production, rather than to pursue only one branch, as dairy or sheep-raising.

How many sheep to the acre can be kept? Just as many as there is grass for. About six coarse wool sheep or ten merinos are considered equal to one cow. Would keep only a few in the pasture with cows. Mr. Winslow's Southdowns average eight pounds of wool. Thought that about 100 could be safely kept in one flock.

Mr. Chapin said: Sheep were once the salvation of Vermont, and may be again; would not advise any particular breed, but prefer a middle wooled sheep, one that would raise a lamb large enough for mutton, and shear a good fleece of wool; the demand for spring lambs is increasing; have noticed farmers who have held their sheep have kept their heads out of water.

GLOVER INSTITUTE.

E. F. Hinckley, of Glover, said: Middle wool sheep are a profitable stock to raise; last year sold $5.50 per head from them; this year raised 57 lambs from 40 ewes; they need good feed, and then there is no trouble about their jumping.

MIDDLEBURY INSTITUTE.

Capt. C. E. Abell, of Orwell, read a paper on the ideal Spanish merino sheep which was listened to with marked attention. Among other things Mr. Abell said: Since a measure of republican leaven has been thrown into the Senate amendment to the tariff bill now before Congress, firmentation has commenced and unless the lump be laid upon the shelf we may expect a taste of the loaf which many of our representatives are trying to prepare for us. Should the present Congress fail to do this, we entertain the idea that the 51st will, so that without any great stretch of imagination we can see the clouds which have so long hung over the wool growing and sheep raising industry begin to roll away. Have we the class of sheep the market will demand? Most of our farmers are ready for the emergency and could exchange fine sheep for greenbacks of large denominations. By untiring diligence and most judicious breeding we have overcome many obstacles and have succeeded in producing the most perfect sheep in the world. Wholly unlike the first original importations, without sacrificing

the purity of blood it has been our aim to produce a class of sheep as perfect as possible in shape, size covering, etc. In shape the ideal must have a broad short head, nose, wide, white and silky, neck thick, the top starting even with the point of the shoulder, with heavy folds beneath; the chest broad and deep; back wide and straight through its entire length; ribs round, legs rather short with large bones and a good muscular development. This framework should be covered with a pelt large enough for two or three such sheep, still belonging to one, folded and pleated about the neck and shoulders. The fleece should be set on the skin very thickly over the whole body, limbs, neck and head, and extending well over the face, density being one of the most necessary points to be considered. The length of the wool as it naturally stands on the sheep's back should be two inches long at a year's growth. Our stock sheep are purchased by the wool growers usually to cross with the native to increase the weight of fleece by multiplying the number of fibers upon a given space, the same as a good farmer makes two blades of grass grow where one grew before.

Deacon Samuel Jones said that the attention of men had been directed to sheep husbandry. From the days of Adam, wool has been one of the necessaries of life. Europe was the first country to try and improve her sheep. We began to import sheep into this country early in the century. The sheep in this county will compare favorably with any in the State. Men come here to purchase sheep to improve their flocks. Our soil, climate and men are well adapted for raising sheep, I can see men in this room who have been eminently successful in raising sheep. We have approached so near the ideal sheep that we must hold on to them. Folds and wrinkles are what are demanded in the market. Men of middle age have made money in sheep. It is true that the prices of sheep have been low for the past few years, but our far-seeing farmers have kept on in the even tenor of their ways. Wool will always be in demand. Men will come here from Australia. They have got to have our best sheep to keep up the flocks in the warm dry countries. Our wools are much stronger than the foreign wools. We want to breed for a beautiful form and as much wool to the square inch as possible, and I am not afraid but that that class of business will pay.

Mr. Jackson—Breeders will not agree on what is the ideal sheep or even which is always the best individual sheep. Care and raising would be a good subject for discussion. It always pays to feed a little grain to sheep, but they will eat just as much hay. Mr. Jackson said in answer to questions that he kept the wool from growing in the eyes by tying a string around the foretop.

Mr. Worcester said he would wrinkle them with shears below and above the eye.

Mr. Sanford would sew through the cup in preference to clipping the wrinkles. Mr. Chapman said he would cut the wrinkles, cutting and bleeding improves the eyes. Wrinkles around the eyes or the tail are a nuisance.

Mr. C. W. Mason said his success in clipping was not satisfactory. When a lamb hurts herself he puts on linseed oil with good results.

Mr. G. C. Cady said young lambs often get their eyes impaired by sucking the ewe before she was sheared. Ewes should be shorn before they drop their lambs.

Mr. Peet said he would have a veterinary surgeon paid by the State to look after the health of our flocks.

Mr. Stickney said he would shear his ewes two weeks before lambing.

Mr. Chapman thought there was less danger in shearing the ewes two weeks before than six weeks.

Mr. Buttloph said the most danger to shearing the ewes was the liability of their taking cold. Lambs take care of themselves better when they are shorn. A lamb should take food from the dam very soon after it is dropped. Dr. Bond thought there was danger in shearing too early if the barns are not very warm.

Mr. Albert Chapman, secretary of the Sheep Breeders' Association, read a paper on sheep husbandry.

He said sheep take less from the soil than either horses or cattle. They also increase the fertility of the soil and permanent sheep pastures never deteriorate. I have known pastures that had to be plowed and cropped to reduce the fertility of the soil. Daisy and some other other noxious weeds are not found in sheep pastures. I know of a pasture which used to keep cows with a large flock of sheep now after a number of years will not keep that number cows without sheep. Mutton is the most healthy and profitable food for family use. Horses can be raised cheaply on sheep farms. The margin is small on any stock, but any kind of sheep pay better with judgment and good care. It does not follow that because some men have been successful in raising the higher type of merino that every one can. A flock master should always select a thoroughbred ram. Close breeding requires the closest attention and good judgment. We cannot retain the largest amount of wool without wrinkles and oil. The Australian market requires the highest type of the merino to improve and sustain a good fibre of wool in that country where the tendency is to have fibre grow dryer and more brittle. This is caused by the climatic influence our strongly bred merinos cross with them and overcome in a measure. We can raise a sheep in Vermont that will weigh a hundred pounds and have twenty per cent. of wool. Feed well, as to feed for existence will not pay. Early cut hay is indispensible. Clover hay is good if well cured. I prefer oats and bran with a small amount of oil meal. For mutton I would feed corn mixed with the oats and bran.

Mr. Winslow, of the Board, spoke on "The most profitable breeds of sheep." The aristocracy of the sheep in the State of Vermont is the higher type of the merino; this class of sheep can be bred for either wool or mutton. A man to succeed in this branch of husbandry must have a natural love for the animal. Every farmer

should keep a small flock of sheep but perhaps every man would not be calculated to breed the higher type of our high bred Vermont merino. A farmer will enjoy any kind of stock raising as long as it pays well. We have large tracts of land in Vermont well adapted to sheep raising. Mutton breeds do not flock like merinos, consequenty they cannot be kept in large flocks. Vermont is the natural home of the merino sheep, her soil, climate and men are perfectly adapted to produce the ideal sheep and there will always be a demand for them to perpetuate the sheep in other countries. They will always have to return here for a renewal of the blood which degenerates in the warm and dry climates. For this reason it is advisable for a farmer who is adapted to the business to continue it. The sheep are injured by neglect and require care all the year round. I think our pure bred merinos can be raised for mutton with success. Cross-bred stock lacks uniformity. Vermont should raise merino wool, as mixed wool is not in so much demand. The merino wool will be more and more in demand as the fashion for broadcloth increases Breed for a strong constitution and a large frame, especially if for mutton. Good breeders will select a ram that will produce the type he is wanted to raise. Feeding lambs in winter is a profitable business and merinos are well adapted to this. Farmers who do not wish to breed for the higher type of merinos for wool can raise a mutton type and still retain the peculiar type of Vermont merino wool.

WESTMINSTER INSTITUTE.

Mr. Davis then annonnced "Sheep Husbandry" as the topic for the forenoon, and introduced as the speaker Mr. C. M. Winslow, of Brandon, as one who would comfort those who believed in this kind of industry and would show how we might see again noble flocks of sheep upon these hills and valleys.

Mr. Winslow said that sheep husbandry would always find a place among agricultural pursuits, for no substitute for wool as a protection against cold had yet been found. It may not be produced in Vermont or the United States but when it is not we shall have to buy it and pay the price asked for it and Vermont and the United States should look to their interests. To-day we do not produce all the wool we use. The tariff duties to-day are so illy regulated that we do not get the protection the government pretends to give us. Even the small protection accorded is nearly taken away by dishonest practices and wrong ratings. As an illustration, the speaker here exhibited two samples of wool obtained at the Valentine mills in Bennington, where only pure wool is used. Under the existing classification, wool waste, so-called, is imported at a ten cent duty and by means of a machine for the purpose is cleaned and worked into good usable wool. The duty on this waste should really be 30 cents for pure wool. There are many other things in the customs regulations that tend to defraud the farmer. Certain reforms in this direction might make wool production remunerative without raising the tariff. The merino

sheep of northern Vermont are the best in the world. It is said to be a fact that in the great wool-producing regions—Australia, South America and the great plains of the western United States —the dryness of the climate makes the wool deteriorate. There is something in these dry climates that takes the strength from the wool fibre and in Vermont there is something that prevents that, so the breeders in these other sections have to return to Vermont to strengthen their wool. Thus Vermont may always expect to have a market for her sheep for breeding. Mr. Winslow then read a newspaper clipping giving an account of a sale of fine Vermont ewes and rams in Australia, the average price for the rams being about $515, and for the ewes about $535. He also told of an Australian breeder, Mr. McCoy, who bought some sheep in Vermont for breeding and chose the highest bred merinos, because the stock in Australia was so much inferior that it required very fine stock to breed them up to the medium grade required. These cases, Mr. Winslow said, show that there is a limited market for this grade but there is much work in raising sheep to this standard and Vermont breeders have bred too much in that line. Their sheep are too greasy and wrinkly to have much constitution and not many of them are enough so to draw the great prizes. A man should not go into any branch of industry unless he likes the animals he is going to raise. He should see something in them beside their money value. He must love his stock to care for it as it should be cared for. Sheep may always be kept on a farm with profit, to a limited extent. A pasture is kept richer when sheep are pastured on it and they eat grass that cattle don't care for. You can get in your care of sheep at no great expense and in the year you seem to have something out of your farm for nothing almost. The variety of sheep to be raised is a question to be decided. The keeping of sheep for mutton has been considered in Canada and Europe very profitable and the consumption of mutton is growing in favor in this country. It is said by physicians to be very healthful. To-day beef production in New England is in a state of depression because of western dressed beef. The West can always produce good beef and put it down at our door cheaper than it can be raised here and the beef is improved by keeping. Mutton must be eaten when freshly killed in order to be good and therefore the West can never compete with us in mutton production for the eastern market. A new industry has been started in the West in which I have a great deal of faith if properly conducted. This is the raising of both wool and mutton. Some cross coarse and fine wool but this is not the proper method. The first cross will be good for mutton but the stock will not be good for breeding purposes. It is better to select merino stock with an inclination toward mutton and a big, broad-backed ram of same type. It is best to keep merino wool on our mutton. I believe there may be built up that which will redeem the sheep industry, which will enable us to produce mutton and to uphold our wool industry. We ought not to buy wool. We ought to produce it.

We should keep our pure merino industry up and I believe it might be made to pay. The next question in mutton raising is the sale. Of course the coarse merino, South Down and Cotswold lambs can be raised earlier and command good prices but there is a profit in raising lambs up to fall, so that $4 to $8 a head can be got from sheep, and this ought to pay. I understand that from one to two-thousand are raised in that way in this section. For the production of mutton alone there are some of the Downs that pay well. I do not like the Cotswolds. The speaker did not see any advantage about the horned Dorsets. When the cattle and dairy industry is up, he said, the sheep industry is down. It is wise for every farmer to get a few sheep and be ready for the rise of the sheep industry. The climate of the State is admirably adapted to it and our farmers should not be so short-sighted as to lose their superiority in merino sheep and to be responsible to foreign countries for the clothing on their backs.

The discussion was led by B. T. Phelps, of Westminster, in the absence of S. M. Nutting. He said that he had had care of sheep every since he was a boy. He lived in Grafton then, a section now open to settlement by Swedes or wild animals, it made little difference which. Sheep husbandry could be made very profitable or very unprofitable. Good keep and good care or poor keep and poor care made the difference. Sheep require a good deal of attention and in the summer like the high pastures. If they run in low pastures they are likely to get foot rot and then they are not good for much. In winter they should have good clover and good feed and be let alone. Sheep should be cared for carefully, and properly treated when anything is the matter with them. My neighbors here have nearly all gone into dairying. I haven't. I don't like to get up early enough in the morning. Sheep don't like to be disturbed early either, so they just suit me.

Mr. George M. Chase gave his experience in the sheep business. He had failed in that and everything he undertook and finally concluded that he must find some way to make money out of his farm without doing any work. He therefore let most of it and only attended himself to his hay and cows.

Mr. Chapin, of the Board, thought Mr. Chase had missed his calling; he ought to have been on the Board of Agriculture. Go about the State, he said, and wherever you find large flocks of sheep there you will find a man of substance. I believe there is money in the sheep business.

To a question by E. A. Copeland, Mr. Winslow said that sheep were kept in dry pastures but it seemed that like all animals they should have water.

A. J. Willard instanced an island on the coast of Maine, without any water upon it, where a flock of sheep summered and wintered without care or cover, and were more healthy than those on a neighboring island, where the owner lived, which were cared for carefully. The grass on the island was rank and luxuriant.

Fred Campbell understood Mr. Winslow to say that Australian

wool was harsher than that from Vermont, while the manufacturers claim that they have to mix that with our wool to get good quality. The speaker thought as much could be got out of the sheep industry as anything. It takes less help to handle sheep than cattle, and help is the great item of expense.

Mr. Winslow explained to the last speaker his meaning, that Australian wool had not the strength of fibre requisite for long combing as have our wools.

WOODSTOCK INSTITUTE.

The day's session was opened by Mr. Winslow, of the Board, who made a familiar talk on the "Sheep Industry." In the earlier days this had been one of the most popular industries in the State, and but for the price of wool would still retain its place. Our hills are peculiarly adapted to sheep grazing, particularly the hills on the east side of the State, and the Spanish merino is proved to be the best for general purposes. Our climate, our hills and our feed seem to give to us the first place in the breeding of sheep to the greatest perfection. Sheep are roving animals, naturally and the merino will always take to the upland and the hills, while the Cotswolds will stay on the lowlands and seek the coarsest feed. But if wool is low a fair profit may be made in sheep husbandry by giving attention to breeding stock sheep for the South American and Australian markets.

Diversified farming is best, and so the generality of farmers should rear small flocks. Every man should select that branch of farming which is most to his taste, and which will thereby secure his best attention and care. If a man does not like sheep, has no interest in them, he will never be successful in sheep husbandry. So of any other kind of stock.

The raising of mutton should be a feature of sheep raising as well as the production of wool. Mutton is recognized as one of the most healthy and cheap articles of food. The demand for it is constantly increasing. Lambs are greatly sought by men who are willing to pay a large price for choice meats, and a few good lambs to turn off in midsummer or fall go a great way in the profit of the farm. Mr. Winslow earnestly advised farmers to breed the merino more for mutton. He believed success open to them in this line if they selected the breeders from the less wrinkly animals, taking especial pains that they are long of staple, broad on the shoulders and back and take on fat readily. Do not undertake to cross with other or coarse breeds expecting to accomplish anything. Success is not in that direction. Improve the merinos themselves in the direction of mutton; the wool is still the same fineness and probably of longer staple. The mutton type of merino is the demand of the day. As purely a mutton sheep he gave the preference to the Southdowns. The Cotswolds he does not like. Their fleece is too open for this climate and fences don't keep them.

In breeding for the South American and Australian markets the speaker thought the more wrinkles the better, for the reason that in these animals the distinctive merino type is more prepotent.

The suggestion regarding the breeding of merinos more for mutton started quite a lively discussion that ran well into the afternoon session. George Aitken advocated the merit of his favorite Southdowns, both for their wool and mutton. For his wool, classed as middle wool, he gets about ten cents more a pound than the merino wool brings, while the mutton is far superior to any other. He keeps his sheep with ordinary fences without trouble.

Henry W. Walker deprecated the breeding of sheep with grease and wrinkles, for any purpose. Vermont farmers had made a great mistake in the past in this matter. The wrinkles interfere with the density and evenness of the fleece, and the grease is of no value and its production enfeebles the constitution of the sheep. The smooth merino is as pure in blood and possesses, in as good degree as his wrinkly fellow, all the valuable characteristics of his species. He earnestly contended that the smooth merino is the sheep to be bred. Mr. Walker, who is not only a successful breeder of pure merinos, but also a wool buyer, gave the average yield of merino wool at about eight pounds per head, while flocks in which there are several rams will average higher, up to twelve pounds. He conceded the superior qualities of the Southdowns for mutton, but thought the merino he had described the better all-round sheep for Vermont.

Albro E. Perkins coincided with Mr. Winslow in regard to wrinkly rams for South American and Australian markets, because with them the desired result will be reached more quickly; still it can be reached with the smooth ram; and after all, this is the type of sheep in demand and that we should breed. They are more rare than they ought to be, and it is almost impossible to pick up a carload. Something having been said about the fashion of fitting up sheep on the west side of the mountain, he was willing to confess that the practice was not unknown on the east side. All were, however, trying now to make amends.

THE FARM.

BENNINGTON INSTITUTE.

Mr. Hickox, member of the State Board of Agriculture of Massachusetts, read an able paper on "How to run a worn-out farm with profit." He said agriculture was the first calling, most important calling, and the mother industry of the whole country—consequently, it is one of which no one need be ashamed, and which every one should foster. Every farmer should love his country, love his calling, or he will not succeed. The same might be said of any other calling.

What is a worn-out farm? Are there no fences? Are the buildings gone? We can raise crops without any of these. It means that our land is deficient in plant food. Our fathers farmed it to the best advantage they could. They literally dipped the fertility from the soil. Why did they do it? Look at the monument in this village. There is one reason, and it speaks volumes. I will only mention this while many others may be named.

They farmed in the 18th century, and we in the 19th. Too many of our farmers are doing to-day just as our fathers did, dipping out the fertility. We must pay back and supply the plant food that has been taken from our land. Lands must be paid back for the elements of plant food taken by the crop. Farmers are too apt to measure their farms by the acre. They should measure them from their homes to the State Capitol, and from there to the National seat of government. Farmers are to blame for the high taxes on our farms. They are taxed in the extreme. The farms in Massachusetts do not cut a ton of hay per acre, and in Vermont just a ton. New England farmers are farming too much in competition with the West. We must raise what they cannot. Grass is king in New England—every farmer knows that—and still we try to raise grain.

In the West they can start gang plows, follow with a seeder, and sow a whole township in a few days, and place the same on our market at a price we cannot compete with them. No use in trying to compete with the West on grain, but hay in Massachusetts is worth $15 per ton, and we *can* and ought to grow three tons per acre. The first three years I ran my farm it did not pay expenses. I raised grain; now my whole attention is turned to grass, and in the first place, saving the fertilizer, I built a barn where it could all be housed, and kept my cows in it. There is no need of making wind breaks for cattle; keep them in the barn. A cow that is giving a good flow of milk is getting all the exercise needed; she wants no yards or wind breaks.

To raise an acre of corn we need fertilizer enough to raise at least 50 bushels of corn. This is worth at present prices we will say, 50 cents, amounts to $25, and the stover worth $10 more, making $35. Now if sown to oats would yield 50 bushels per acre, worth 30 cents, and straw $10, makes $25 for crop. Same land if put into ensilage corn, would yield 25 tons, equal in value to 8 tons of hay worth $15 per ton, is $120; or if in grass alone would be 3 tons of hay worth $45. Now which shall we grow? Grain in competition with the West, or what crops are needed by every farmer?

My practice is to manure for corn about 20 cords per acre, with some phosphate. I then sow to oats, using about 200 pounds of bone meal and potash to an acre, cutting the oats just as they begin to turn yellow at the bottom, and get about three tons of oat hay worth, at least, as much as three tons of timothy hay.

The grass seed is sown with the oats, and top dressed after the oat hay is taken off.

In answer to question, Mr. Hickox said: I put the oat hay into the cock, and let it stand two or three days, open, and draw in. Handle it same as clover. I have used muck; think it good as an absorbent; use saw-dust for bedding. My mowings are kept five years in grass. Am wintering 100 head of cattle on fodder cut from 65 acres meadow. Am breeding Jersey stock, selling the older cows and keeping the heifers. The stock bull at the head of the herd is eleven years old.

M. W. Davis, of the Board, spoke of the "Wastes on a Farm." The geological formation gives to Vermont one of the most varied and fertile soils of any State in the Union. The farmer of Vermont has been unmindful of soil and his crops, and to-day is crying out that farming does not pay, while her former reputation stood most enviable of any of the States in her sheep industry, going to the old country and importing and bringing to Vermont, to the town of which I am a citizen, and there under the care of a Vermont shepherd, with Vermont soil, producing a sheep, which taken to the old country at Hamburg Exposition, took the first prize against the world. In horses, she stood at the head, and her men, in war, in peace, and in National council, none other equaled. Now the cry is depopulation, desertion of farms, farming a poor business, don't pay.

To remedy this, my associates for the past two days have been telling you to produce more and cheaper, make two blades of grass grow where but one does now, cows to produce 200 or more pounds of butter where now only 130, and now I am here this evening to tell you to take care of what you have already produced, by stopping the waste in your business.

The first great waste is the inadaptation of the man to his business. If he is adapted to it he will live; if he lives he will make it a success. Now, if he is a farmer, he must have an idea of what he wants to do, and work with judgment and discretion to secure that end. If a dairyman, he must select the farm adapted to that business, orhe will make a waste. He must grow sweet, succulent food for summer or winter, and have pure water, with accessible buildings, located convenient to lessen labor and meet all needs for the purpose assigned. So with the house and all the outbuildings, constructed in a warm, comfortable way in every respect for the stock.

There is a great waste in irregularity in feeding cattle, in the selection of the wrong animal for the purpose wanted. Keeping cows that will produce 18 per cent. cream, while others produce 30 per cent. Great waste in an unsuitable team for the farm and tools. Great waste in the want of care of tools, not housing or painting; waste in home fertilizers of the farm, by being exposed to the eaves-water, sun, wind, etc.; want of absorbents to hold the liquid, which is 60 per cent. of the whole; should have barn cellars for manure, or if thrown out a lean-to roof to cover. Horse manure should be kept from burning up, saved by keeping wet, stirring by hand or by hogs, or applying plaster; absorbents in stables of all kinds, calves

and pigs to extend the manure pile, as well as to save the liquids. Utilize the sink-spout and house slops, etc. There is a great waste in the diminishing of the crop by improper preparation of the soil for the crop; in the improper crop to the soil in which the crop is to be placed. A judicious rotation is an absolute necessity to hold the fertility of the soil unimpaired; thorough cultivation and manipulation cannot be too much kept in mind.

Harvesting crops at just the right time, fitting them in the very best manner for sale or consumption at home. When ready for market there is a waste if not sold, nine times out of ten, by holding. More system in planning work to save hired help; raise more corn, and buy less; keep farm accounts and know what you are doing; buy not that which you can do without; be careful of auction sales; spend no time uselessly around hotels, shops, etc.; take good agricultural papers to learn all there is knowable about your business; represent yourselves in the Legislature in a manner that will take care of the interest of agriculture; speak well of your vocation; take care of our home interest; our children, by making our home attractive as circumstances will permit—then Vermont may sustain her prestige as being first in war, in peace, and statesmanship.

BRANDON INSTITUTE.

At the Agricultural meeting at Brandon, Hon. C. M. Willard was chosen chairman, and also gave an address of welcome. He said: The people of Brandon appreciate the value of this Board, and we give you a hearty welcome. The work of the Board has always been fruitful of good. It is a saying old, and none the less true for being old, that farming is the basis of all other industries. Without agriculture what will become of commerce and manufactories? It underlies all other business.

This country and this business brings out the best men this country ever knew. We hear too much said about abandoned farms. It is true that last year was a poor one for a majority of farmers, but there is an ebb and flow in any business. There is no earthly reason why farms should be offered for sale for just what the improvements actually cost. There has been a great rush for the West, and the Western country has been built up by the energy, wisdom, and capital of the East, and it is no wonder there should be a reaction here. Farmers should study more carefully their work; work with diligence and practice economy.

BROOKFIELD INSTITUTE.

Prof. Dole: We should all be interested in our Vermont farms that do not bring more than one-half as much as before the war. A farm in this State, where buildings cost $3,000, sold at $700. It is time for us to cast about and see what the trouble is. I think as much money can be made by farming in this State as any. If we were to average the country through, would find Vermont as good and as safe as any State to farm it in.

DORSET INSTITUTE.

A full house greeted the Board, and Charles B. Kent was elected chairman. He said the meeting at that place last year was a decided success, and the fruits of it were plainly visible. We wish the Board of Agriculture could hold up the business of farming in such a light that more of our young men would remain at home on the farms. Too many go West, and those who stay send them money to pay for their farms at from 7 to 15 per cent. interest. If many of the boys who leave their homes in Vermont would deny themselves as much here, and work as hard as they do in other places, they would in many instances be much better off. Most Western lands are heavily mortgaged, and Vermont has too much money invested in them. While farmers are deploring the condition of our own State, let them look to others. Vermont cows produce 128 pounds of butter per cow, while Kentucky cows produce only 60. We raise 35 bushels of corn per acre, and Kentucky only 26, and other products in like proportion.

M. W. Davis, of Westminster, said the geological structure of Vermont, interspersed with marble, lime and slate belts, gives her the strongest soil in the world. We have been drawing from this soil for the past 100 years, and now it cries out for something to recuperate it. We must feed the soil better, and it will still produce. Vermont raises the most corn per acre; also the most wheat and other crops. This is the ninth year I have traveled over the State, and the more I know of her the better I love her. Vermont has given over 300,000 boys and girls to the West. They carry with them Vermont character.

To be a successful farmer a man should have a natural adaptation for the work. It is much better to be a first-class farmer than a third-rate lawyer. If you are going to be a farmer make your ideal and stick to it, and you will succeed. When I see Western beef and Western corn laid down at our doors so cheaply, I say we must turn our attention to something else. Vermont is a natural dairy State. Addison county can raise the sheep. When you have the farm and the right cow, you can look upon your fodder as so much butter and cheese. We need to learn how to plan and systematize our work. We waste enough to make us fail often. Farmers also want to know how to sell their products and generally should sell as soon as an article is ready for the market. We are apt to buy too much. I wish I could place this motto on every door in the land, "We will buy no more than we can pay for."

Prof. Dole, of Northfield, spoke of the home life, which more than any other one thing makes the ideal farmer. He believed the surroundings of our homes should be made as attractive and beautiful as our means will allow. Beautify your homes with flowers. A piano or organ should be found in every household where a family of children are being raised. If farmers would study more to systematize their work they would be more prosperous. I do not

think as a class they live any better than they should, but every farm should be made to produce to its full capacity. Every farm should produce its small fruit, and strawberries are cheaply grown and are a luxury.

Our schools are the safeguard of society and the most important offices we shall be called upon to fill will be our school commissioners. We should give the new law a trial, and if it is a failure it will be disposed of at the next session of the Legislature.

FRANKLIN INSTITUTE.

At the afternoon session Mr. Edward R. Towle, a former member of the Board, read a very instructive paper on "Gathering up the fragments." He complimented the present Board on the work it has done. He said: I have always been a farmer and have studied and planned with some success. Our available lands are all occupied, and it would be hard to find a town where so many farms are owned and carried on by the descendants of the original settlers. The productive capacity of our lands is wonderful, and the cause of our low prices, in a great measure, is over-production. Our creameries in this section have paid fairly well. Dairies that sold in season were remunerative, but what shall be done with the cold storage is a question. The coming year will see the produce put upon the market earlier than has been the custom. What other branches of farming shall we take up? Sheep husbandry in small flocks is proving remunerative, and that branch of husbandry is commendable. It is not certain that the coming season will be as productive as the last, and it would be well to look ahead. I have always kept cows and shall keep along with the dairy. Prices will be low and we must increase the product. Sift out the cows. The number of cows is not of as much consequence as the quality. The best possible care should be taken of all kinds of stock. Every animal needs a certain amount of feed to support animal life; after that the feed for profit comes in. Swine, poultry and calves are accessory to the dairy, and would recommend poultry to the care of women and children and have them share in the proceeds. Sugar is as high in price as any product and should receive attention at the proper season. It is not cheaper to buy grain than to raise it. If cows are expected to do their best, must be well fed. Much work can be accomplished if properly planned.

Mr. Fassett said that if the present low prices continued a farmer could not pay much attention to farm improvements, make the cows produce twice as much as they now do, and two spears of grass where one grows now.

Mr. Smith, of the Board, spoke of seeding down to grass and inquired of the methods and practices.

Mr. Towle said: We seed in the spring with grass.

Mr. Smith said: In some localities they sow grass seed with the corn at second time of hoeing; of course perfectly level culture is practiced, and good results are obtained.

Mr. Fassett said: I raise little or no grain, and top-dress my meadows; get best results in putting on the mowings soon after having if the weather be rainy.

Mr. Olmstead said one thing that was the trouble with farmers was that they were too extravagant. There was too much money in horses and carriages. He did not believe much in Jersey cows, and if he was a member of the Board would never mention them.

Mr. Chapin thought that Vermont never would be a large manufacturing State, hence her prosperity will depend largely upon the farming industry. He would remove the stones as fast as possible, as they are a serious obstacle to good farming. Would not have scattering trees in cultivated fields. Mr. Smith would pasture the meadows, Mr. Chapin would not, thus showing the difference there may be in soil and situation. Would dispose of interior field fences as far as possible, as keeping them in repair costs more than they are worth. He spoke of draining wet and swampy lands with stones with good success. In this way he gets rid of the stones and improves his land at the same time. Weeds are serious obstacles to good cultivation. They can be killed by persistent effort and not allowing them to go to seed. Heavy crops of grass or grain will do much to choke out the weeds. Our soils are largely hard and unyielding and require the use of the best pulverizing implements. But we have these and can ameliorate the soil with a judicious use of them. Warm barns and stables are indispensable to success with stock.

One of the worst obstacles is a mortgage on the farm, stock or crop. Would advise farmers to keep out of debt as far as possible. The speaker filled in his address with such telling illustrations and funny incidents, that it was received with the greatest pleasure by the audience. Our lack of faith in our occupation he considered a great hindrance to success. This is a sad admission and ought not to be the case. He predicted a good time for Vermont by and by. So may it be.

GLOVER INSTITUTE.

Mr. Chapin, of the Board, who was assigned to the topic of "Farmers and Farms," began in a manner peculiar to himself, and put the audience in the best of humor and relish for his address. In the history of Vermont, farmers figure very conspicuously in the most important events of every period. Those who pushed up from the older New England into the Vermont wilderness were seeking lands and sites on which to clear up farms and build homes. They came bringing along with them the school and the church; they reared good, strong, noble boys and girls. Those who came were picked men, whose courage, enterprise, brawn and brain were such as could alone succeed under the circumstances. They had not only the climate, the wilderness and the savages to contend with, but soon became of necessity embroiled in the controversy over the right of the two neighboring states, New Hampshire and New York, to claim the territory of

Vermont. Those who were brought to the front in those early times were farmers. Allen, Warner, Baker and others were mentioned as being worthy farmers. Men of this day look with pride on our ancestry of noble farmers. The question was asked whether the men of this day are worthy sons of the honored set of men who first came to fell the forests on these hills and through these valleys. Mr. Chapin stated that just at this time things "were out of joint" somewhat, and needed righting. As a result of war times a second crop of evils exists, among which were mentioned a moneyed aristocracy, high taxation, high salaries, etc., the expenses resulting therefrom falling largely on the farmers. The speaker thought the farmer failed to get his political rights and that his voice was not sufficiently potent in matters of legislation. Reference was made to the subject of "abandoned farms," of which considerable has been heard of late. Mr. Chapin thought that considerable of the old rough, rocky land, once occupied by farmers, might revert back to forests without doing harm to the citizens or the State. Statistics showed that not 4 per cent. of our farm lands heretofore cultivated could be classed as "abandoned." The speaker remarked that all of our lands and farms, whatever else they might fail to grow, might yield a rich harvest in a good crop of boys and girls. Reference was made to the fact that Vermont stands first and among the very first in the amount of several kinds of crops raised per acre. Vermont farms to-day are more productive than ever before, and except in few places the soil of this State is as productive as any.

Vermont farmers should see to it that they are not beaten by humbugs, and that in politics they have their rights.

Mr. Winslow, of the Board, stated that it was not possible for him or any one else to give specific rules in regard to farming in different localities. The farmer, having studied his soil and his conditions, must be his own judge of what promises best. Every farmer ought to thoroughly know his soil and what is adapted to it. Experience is the best teacher. While the times are called hard, many men are making money farming. Their whole business should be done in a thoroughly business manner. Some farmers are shiftless, wasteful and lazy; they cannot succeed at farming nor would they thrive at anything. To make the farm profitable in hard times, one needs to study and plan all his operations to save unnecessary expense, to do the most work with least expenditure, to force the soil to yield her best returns. In stock raising one thing is well known and that is that well kept stock pays, if stock pays at all. Specialties in farming are hazardous; the mixed farming has more promise of success. It was remarked that the good done by the Board was chiefly in the agitations and discussions among farmers produced by the several meetings.

POMFRET INSTITUTE.

The Pomfret Farmers' club meeting which was held at the

town hall, Friday, February 22, was called to order by Hon. Crosby Miller, and Edwin Allen, one of the Vice-Presidents, was called to the chair. After singing by the club choir, A. E. Perkins spoke upon "Farming, past and present compared." Many of our farms were settled over 100 years ago by settlers from Massachusetts and Connecticut who found fertile soil and dense forest. They made a great mistake in cutting the timber off the hills which God intended only for the growing of forests. Ascutney mountain was once sold for table land. The same old story respecting the immense size of the vegetables was then told as is now told of those of California. The log houses were furnished with two kettles and a spider for cooking; spinning wheel and loom for the manufacturing of the family clothing, and the housewife was cook, dressmaker, milliner, etc.

The farm implements consisted of the axe, shovel, stub shovel, hoe, fork, scythe, hand rake, pod augur, harrow and wooden plow. Later the wagon was introduced, being built strong with good stout axles for springs. At the present time our farm implements are too numerous to mention, and horse and steam power are taking the place of hand power in nearly every line of work.

Our market then was Boston and all the freighting was done with teams, costing about $1 per 100 pounds. Our butter and wool industry was only to supply the home market, and our maple sugar, which was then only consumed at home, has now a world-wide reputation. More "Vermont maple sugar" is manufactured in Chicago at the present time than in the State of Vermont. He compared many of the staple crops of Vermont and Illinois, and showed that we raise more bushels of grain to the acre and receive a much better price.

There is something wrong in our placing a set of $5,000 buildings on a $2,000 farm. It does not pay to raise scrub stocks of all kinds or to keep good stock in poor condition.

J. C. Sherburne spoke upon "Larger farms." He said that farm expenses had outgrown the farms and that the farmers about here are not growing richer. While we raise almost double the farm products, our expenses have increased in a greater ratio, as the farm is the best place in the world to spend money. The young men leave the farm because our farms are not large enough to give them business, as young men say there is no business on a small farm. Thought our farms were too small, as it was easier getting three tons of hay off of two acres than off of one. One ton of phosphate would purchase 10 acres of good grazing land and that the grass growing on 10 acres will make more butter or beef than a ton of meal, and he advised buying more land and less of meal and phosphate. It does not take much more labor or team help to carry on a large farm than a small one. To run a dairy of 10 cows it is necessary to employ the services of an extra man and girl while five men could run a dairy of 100 cows. One-half the men and teams in this town could do all the work if rightly

managed. Farmers must be business men and hold up their heads with professional men, as the farmer is the peer of any man.

Aden Bugbee criticized Mr. Shelburne's large farm theory.

The morning session was closed for dinner in the hall.

M. W. Davis, of the State Board of Agriculture, spoke upon "Farmers' Homes." He said that he would first stop the great flood of immigration to this country, as much of it was the throwing off of the outcasts of all countries. He wished that Vermont could retain her old Puritan stock of inhabitants intact. We are in danger of being supplanted by foreigners. Farmers' homes are the strong forts of civilization. So many young people leave the farms because they are not made attractive. Arrange the farm and buildings as to be convenient and attractive; it costs no more and only a little foresight. Let the home be an oasis to the family. The farm home is and should be the place to educate our great men. The making of the home is no trifling matter. Be careful not to be too exacting or extravagant, but be economical and encourage one another in paying for and making the home bright and happy.

A great mistake of farm life is buying all the modern machinery for cultivating the farm, while the housewife has nothing to aid her in her work. Let man and wife be co-partners in the farm work; let the wife understand the work of her husband and enter into it in spirit. As the woman rises in character, so man rises.

Ryegate and Pomfret are the banner agricultural towns of Vermont, and he urged the farmers to take courage, as the tide of emigration was turning from the West and our depopulated towns would again be populated.

STOWE INSTITUTE.

In the afternoon a large audience listened to an interesting paper on "Farms and Farming," by Hon. William Chapin, of Middlesex.

Mr. Bingham said: "Mr. Chapin, I suppose you know everything; tell us what will kill out the brakes upon our farms."

"Well," said Mr. Chapin, "that is one of the few things which I do not know. I have mown brakes ever since I was large enough to swing a scythe, and they have seemed to thrive upon it. In my opinion, however, if they were mowed six or seven times a year, it would discourage them terribly."

Mr. Smith suggested that if the brake should be ploughed up late in the fall and left, it would have the desired effect.

George W. Wilkins asked Mr. Chapin to instance discriminating legislation against farmers.

Mr. Chapin spoke of the Savings bank and the Central Vermont railroad as such instances.

J. W. Newton followed with a talk on "The New Agriculture." He sketched the oleomargarine fight in Massachusetts as a result of the power of farmers when united. Mr. Newton

strongly condemned the folly of a farmer wasting the fertilizer that should accumulate on his farm, and then buying other fertilizers. He spoke highly of experiment stations as a means of elevating the farmer.

Mr. Wilkins: "Are these experiment stations an instance of legislative discrimination, Mr. Chapin?"

"No," said Mr. Chapin solemnly, "that is just the other way. Even the devil does good sometimes, I suppose."

In the evening M. W. Davis, of Westminster, spoke on "Economy in Stock Feeding." Economy should be the central and great idea to every farmer, from which will radiate all these methods. Mr. Davis strongly advocated the raising of corn and clover, as did also Mr. Chapin.

WEST CONCORD INSTITUTE.

Mr. Willard Chase, one of the best farmers in Essex county and probably the largest sugar maker, was elected chairman. Rev. Mr. Scitz gave the address of welcome.

He said in visiting in an adjoining State he was stopping at a place where lived an agricultural writer whose specialty was gardening. On visiting the garden he was surprised to find the most neglected spot in town. He thought these meetings should be addressed by practical men and practical subjects discussed. He had great faith in Vermont farms; their capacity is as good as in other States; believed in the preservation of the forests, barren mountains mean barren soil with less water in the rivers and less rainfall. True, we have some deserted farms, but they are of more value to grow up to wood again than to populate with Swedes, and have them try to reclaim them. They are either worn-out mountains or are too far from railroad centres to be valuable for farms. Had very little faith in the Swedish immigration scheme. Swedes will do just as the Yankees do, work where they can get the most money. Man seems to be destructive to rich soil. Spoke of the primitive soil of Vermont and how the original settlers thought it inexhaustible, but found out their mistake when it cost a great amount to reclaim. Where you have rich land keep it so. It requires tact, skill and muscle to be a good farmer; would advise young men to go to farming in Vermont and stick to it.

Mr. Davis, of the Board, said: We do not come so much to instruct as to discuss with others the different subjects. One great trouble with our farmers is they do not put thought enough into their work. We want to see all the young men at these meetings. We ask no Swedes to come here; rather have the native stock.

Mr. Chapin, of the Board, said: We need to put more thought and study into our work. Getting a living by the sweat of the brow does not mean simply muscle work, but brain work.

WESTMINSTER INSTITUTE.

The chairman of the meeting, M. W. Davis, gave the opening address, as follows:—

Gentlemen of the Board of Agriculture: In behalf of the citizens of this town and county I most cheerfully welcome you to the town of Westminster, which we love and the county respects. We welcome you to this historic town, where the first blood of the revolution was shed, reminding you that you are seated above the ashes of that noble edifice built in 1880 and destroyed in 1888; reminding you that on your way from the depot you passed the spot where the historic "court house" stood, where William French, the first martyr to American freedom, was killed by Tory hands. May our citizens be painstaking in showing you these spots of interest as strangers. May you and your people clasp hands as one brotherhood and unfold a better understanding of the oldest and noblest industry man ever engaged in. As the representative agriculturists of Vermont, taken from the farm, with more or less experience, brought in contact with men of practical knowledge, together with years of observation, may you bring us much of practical thought. You come in contact here with people who think they were cast in a pleasant place, and yet they will listen to you in a teachable spirit. The town has sent scores of young men and women to people the West. And yet with these natural and acquired advantages, you will find a people in a state of unrest. With the best of railroad facilities and superiority of market, with good average production, you will hear complaints that these people cannot more than keep square with the world. We hope you will take notice of this fact. We have produced here 131 bushels of corn to the acre, and the best sheep in the State and in the world we think. A great change has come over us, and we look for help to you who are to tell us something of the obstacles to farming. Your field is unlimited. The gentleman who is to present a somewhat new method of utilizing farm crops will have attentive listeners on the subject of silos, and the one who speaks of the dairy will strike the key-note in many sections of our country. It looks now as if the Jersey would soon be seen where a few years since the noble sheep found place, and we are glad to hear from a friend on this specialty. Again we welcome you here. We are unable to show you factories or fabric mills, but we can show you our creamery and our wagon manufactory, and our steam and water saw and wood-working mills, and the largest basket manufactory known. Otherwise we are purely a farming community, with markets outside our lines. As we feel the magnitude of our calling we feel the declension of its practical working. Is the political machinery of our country wrong? Is it to serve the selfishness of a few wire pullers and knaves who are to run the wealth of this country into the hands of less than 25,000 men? We greet you again in these two days, and petition you to give us the remedy for these numerous ills, which many, if not

all, of you have met many times in a Vermont audience. We mourn the unrequited labor of the farm. We have neglected to push our cause full to the line of justice, thereby surrendering our birthright, enslaving ourselves and our posterity by demagogism; if by want of confidence in ourselves or by neglected education we have failed, we welcome you here to advise the remedy. Perhaps you can tell us how to increase our crops with less expense, make our fields more profitable, our homes and surroundings more attractive and our assets enlarged. We welcome you to our homes, to our families, hoping that they may be pleasant to you while you are with us.

The next number on the programme was an address on "Obstacles in Farming," by Wm. Chapin:—

Why is it that Vermont, the land of the Green Mountains and Green Mountain boys, stands still and relatively falls behind her sister States in the grand race of progress that is going on throughout the whole Yankee nation? Why is it the last census shows in Vermont a gain of but ½ of one per cent. on population while New York, on our western border, gains 16 per cent., Massachusetts on the south 18 per cent., and rocky New Hampshire on the east 9 per cent.? Something is wrong. What is it, and how shall it be remedied? Let us candidly consider what our hindrances are and try to study out the remedy. The world does move, and we must keep up or be lost sight of in the procession of progression. Vermont is an agricultural State without a mile of seacoast and with little lake or river navigation. Until the rates of transportation of raw materials and manufactured products are greatly reduced Vermont can never be a manufacturing State. The same thing may be a help or a hindrance according to where it is placed. A lot of loose stones or boulders in a plowed field are obstacles to successful farming, while the same stones laid into the foundations of buildings, drains in swamps, or walls to protect the banks of brooks, serve a most useful purpose. Remove the stones as fast as possible. The smaller ones can be readily picked ed up, and a good dump cart is the handiest conveyance. Dispose of these in walls, low places or dump them as a monument upon larger rocks. For larger rocks than two tons' weight a pair of oxen, a drag rake, and three men, will accomplish much. Again, scattering trees in cultivated fields should be removed. Have you groves or shade trees on the rocky hills, but in the field they are an obstruction and a damage. It is better to take up a tree, roots and all, than to be bothered with the stump for years, and this can be done easier than the stump can be pulled. Unnecessary fence is another obstacle to Vermont farmers. The old walls that cover land and shelter vermin should be cleared away. Then more time could be given to line and pasture fences and there would be less trouble among neighbors about straying stock. On most Vermont farms swamps, sloughs and mud holes are obstacles. Drain them properly and they will pay you well. Tile draining I know noth ing about, but stone drains have done good duty on my farm for

thirty years and have never failed where properly made. No doubt tile is better and cheaper to use where stone is not handy. Another good point is to straighten and deepen the channels of crooked and sprawling brooks.

The speaker then referred to weeds, the common obstacle to every farmer. Let the plow and cultivator do their perfect work before these weeds go to seed. Docks, plantains, hardhacks, daisy, goldenrod, etc., must be pulled up, burned up and dug up. They can be subdued if not killed out. All needed is determined will. Keep the ground well occupied in growing useful crops. A full growth of grass, grain, corn, or other rank growing crop that fully covers the earth will do more toward removing weeds than hard labor on an unoccupied field. Many fields have become hard and sour by the hoof beats of a hundred years, and the weight of winter snows. They want stirring up and pulverizing, making them light and mellow. We have the best pulverizing implements in the world. Let us learn to use them. Our crops ought to be matured and out of the way of frost by September 1. Put crops in early and use early varieties as a general rule. When fairly ripe don't wait for the frost to catch them. Make your stables and the basements under them warm and have them well ventilated; let in plenty of sunshine and your stock will flourish. Your watering troughs should never freeze. Grass is the main anchor of Vermont's agriculture. "All flesh is grass."

WOODSTOCK INSTITUTE.

Mr. Davis, of the Board, spoke of The Wastes of the Farm. These abandoned farms we hear so much about were once fertile. They have been ruined by constant use, without care, and the application of recuperative agents. Save the waste about the farm and study nature, which teaches all that is required. A farmer cannot succeed with a feeling of unrest and discontent, but must put his whole life and energy into the work. Man wants to be something he cannot be. If he is cut out for a farmer he will succeed, otherwise not. He cannot succeed as a breeder unless he loves stock. The lack of these essentials is one of the most common sources of waste. Have a place for everything, and everything in its place, otherwise much time will be lost in looking for a needed article. Another waste is in the stock, some of which cannot be made to gain, no matter how much it is fed, and is not worth wintering. As a rule, in buying, people make poor selections, not realizing that it always pays to purchase good stock. Feed regularly, and try and learn to do it judiciously. Some animals require more than others, and if the stables are warm, as they should be, less feed is necessary. Herein is a great waste. By having everything convenient about the house and other buildings, there is a saving in hired help. Farmers cannot afford to hire so much. In Vermont they pay yearly $127,000 for fertilizers, and buy 2,000,000 bushels of corn. Save the manure and the expense of the fertilizers, and spread the manure at this time of year, and

thus save the most. Don't buy pianos and top buggies unless you can afford them. The majority of farmers are in debt and discontented, and don't attend to business. Keep a diary, and at the end of the year it will be found that many things were purchased that were not needed. Train the boys and girls to be strong, morally, intellectually and socially; to economical and regular habits. There is no success if one half the family pull against the other. Sell when your product is ready for the market, and don't incur risks, and waste time worrying about a cent a pound. Always carry something to market when you go to town, and don't go to town unless you have something to go for. No man is worthy of being a farmer unless he takes a good agricultural paper. Don't stand by the roadside two or three hours a day and talk politics, but send men to the Legislature who will work for your interests, and who cannot be bought.

APPENDIX.

A TALK WITH FARMERS' WIVES.

Read by Mrs. A. J. Gibbs, of Fairhaven, at the Benson Meeting.

A *talk*, as you all know, is peculiarly a woman's privilege. I have even heard it intimated now and then, that we not only will *talk*, but that we insist upon having the "*last word*," but of that I have my doubts. As I am a farmer's daughter, and for the last thirty years have been a Vermont farmer's wife, I may be pardoned for saying that I bring you to-night the results of some observation, and of a little experience.

I have no fine-spun theories to maintain, and do not propose to theorize at all, but simply to tell a few plain truths in a plain way. I know right well the lights and shadows of farm life, from the time the sap first starts in the maples, and the arbutus buds on the sunny hillsides, to the time when the snow lies deep in the woodlands, and the river is bound fast in icy chains. I have watched as eagerly as any one of you, for the morning when some one discovered that the russets in the cellar are getting a little mellow, and says joyously, "Spring is coming." I have listened as intently as the youngest here, for the first faint peep from the marshes that tells us the frogs are once more awake, and in concert trim. And some morning when the snow still lingers, the song of the first bluebird of the season assures us that winter is indeed ended. For a month the willow catkins have worked as if there was new life stirring within, and the rich brown furrows in the plowed fields, crumbling a little under the pressure of the foot, say that seed time has come, and the spring's work has begun.

In this season with great regularity, "the new hired man" puts in his appearance, and with far less certainty "the new hired girl" appears also. But the regular spring work does not fail. The stores of milk in the milk-room increase daily, and the churn is brought out with greater frequency. As this paper is meant exclusively for farmers' wives, let me say a word to you confidentially, right here. When that churn is brought into requisition it is well to let a stronger arm than yours handle it until the butter comes. I know it is a virtue to be economical; it is necessary to be saving upon a farm if one would live, but I believe that one of the wisest economies—one of the very best things to save—is to save yourself. Yet it is not good economy to keep a man busy for a half day with the churning, when he feels to the very tips of his

fingers that he is needed in the field, just to save the expense of a dairy thermometer that will tell at once when the cream is at the proper temperature to give good and quick returns. To be sure we are Yankees, "to the maner born," and are, as a rule, tolerable good guessers, but *guessing* the cream is *about* right, is quite different from *knowing* it is *just* right. I speak from experience, having tried both ways.

About this time of year we begin to think of a little pocket money from eggs and early poultry. Of course there is not a farmer in Vermont who would think of putting that money in his own pocket. If such men have ever existed, we are confident the species is extinct, and only to be found in the shape of an antediluvian fossil, and we are not anxious to find even his fossilized remains. I have usually had good success with broods of chickens hatched from the middle of March to the first of April. It helps wonderfully to retain the warmth about the eggs so early in the season, if the nests are well lined with old newspapers. As far as I know, the idea is original with me, but there is no patent upon it; any of you can try it, and welcome. After the chicks are hatched, it is well to get them upon the ground sunny days as often as possible. I have alwas found it best to *feed* them upon the ground when I could, and thought them healthier and stronger for the exercise they thus obtained.

About patent incubators and artificial mothers, I can tell you nothing, not having had experience in that direction. The best incubator and artificial mother I ever tried, was a small yellow hen that hatched fifteen chickens, and adopted twenty-four more, and brought up the thirty-nine without a single loss. If one has a fancy for the business, it is no great task to raise fifty or a hundred chicks upon almost any farm, with no outlay for *fixtures*, but a few dry goods boxes for coops. Of course fancy hen houses and fancy nests, and fancy fowls, are all fine for those who have plenty of leisure, but you and I, as farmers' wives, have no time to attend to them. We only expect to have a good supply of eggs, and a hundred or so of nice chicks that we can sell for a good price to these poultry fanciers.

Some morning, after the grain is all sown and the early chickens started, when the pansies are growing stocky and strong beside the tomato plants in the south window, while looking for your Sunday bouquet, you suddenly espy upon the south side of an apple tree (Red Astrachan, of course,) one solitary bunch of blossoms which you seize triumphantly. Next day there are a score of them, and the next the whole tree is a mass of snowy bloom, with robins flying in and out, setting up their spring housekeeping. A few days more and the Maiden's Blush is ablaze with its close-shut buds of scarlet and white, which will soon change to the lovliest shades of pink. Then come the Baldwins and Northern Spys, later and larger, as befits their usefulness. Who that has ever seen it can forget the exquisite beauty of a New England apple orchard in blossoming time?

I know trees so knarled and old, they have, to all appearance, outlived their usefulness, yet when the sap mounts up in the spring, and the days are steadily growing longer; when the oriole flits in and out of his old haunts, they feel the pulse of youth beating once more, and burst into blossom as easily and naturally as the bluebird sings its love song.

Perhaps your artistic fingers will transfer to canvas some memory of this spring-time glory, or your busy needle embroider the delicate pink and white sprays on softest satin. Be that as it may, keep the beauty of it in your life and heart. Do not be so engrossed with work that you let this living poem, glowing and living by your very threshold, pass away unread. Take time to enjoy it. This blossoming time comes but once a year, and your years are growing fewer. Bring the generous clusters into the house until it is filled with their fragrance. Nature is not niggardly in her gifts, and furnishes enough for both use and beauty.

A few weeks ago I saw a letter from a minister who went out from among us a few years since, and with the love for our scenery still living in his heart, he ventured to hope that when he died he might be assigned to the department of Vermont, and I am very sure he would like best to come when the apple blossoms just begin to cover the ground with their mimic snow.

But this is the poetry of farm life, and we will come back to its plainest prose, and call it "house cleaning time," for if you are a wise woman you will not have begun this task much earlier, though I have known very worthy women, model housekeepers they called themselves, who took pride in getting all through with this yearly revolution before the first of May. But a strict regard for truth compels me to state they have been in the burying ground for many years. Whether the two facts have any relation to each other, I will not say, but leave you to imagine. Ask any intelligent physician if it is wise in this climate to take down the stoves, and take out the windows so early in the season, and he will probably say *No*, in a very decided manner. There is reason in all things, and while cleanliness and order are *desirable*, nay, essential to one's health and happiness, it really is not necessary to go around the house the greater part of the time with a scrubbing brush in one hand and a wet rag in the other, on the *qui vive* for a bit of dust or a fly speck. When things are really decent and in order, possess your souls in peace. I know this doctrine is rank heresy in New England, but I say it deliberately, though with a vision of fagots and the stake before me, and I further confess to a great deal of sympathy with the woman who said she didn't want to go through all eternity regretting that she spent the whole of her probation here *scrubbing a board*.

I hardly know which is the *worst*, "the house that keeps itself," where the lamps are filled when it is convenient, and the baking done in the afternoon or evening; where the chairs are dusted with the whisks of an apron, and the meals prepared when the

presiding genius *happens* to get ready; and where "some other day" is the appointed time for most things, and the house of *Never* is invariably sought by the road of Bye and bye; I say, at the risk of shocking some of you, I hardly know if this is much worse than the house kept in such perfect and immaculate order that it is too exquisitely fine for use. In such houses one has to remove his shoes like an Oriental, before crossing the sacred threshold, and can hardly have even the liberty accorded by a photographer to his victim, when he says, "now look pleasant, and wink as often as you please." A very nervous person would soon die of so much restraint. Such a housekeeper is a martyr, and the slave of her house instead of its mistress. Neither extreme is to be commended, and as an individual, I should greatly prefer heaven to either.

With what our grandmothers called "faculty," which is simply the use of brain power in the conservation of forces, much time may be saved even in the season of busiest work. The Germans have a proverb that, "The morning hour has gold in its mouth." We express about the same thing by saying, "If we lose an hour in the morning, we may chase it all day, but cannot overtake it." Both are true, and order and system are nowhere more imperatively needed than in the farmer's home. Then use these golden morning hours diligently and wisely. Work carefully planned seems half done. It is sometimes said that no true daughter of New England takes two steps where one will answer, while about her work, and it is by being thus wise in planning, and diligent in executing, they enjoy the well-earned leisure of the afternoon. Yet we cannot make our laws like those of the Medes and Persians, that cannot be altered if occasion requires, for circumstances may make a change of programme very desirable.

Now if I intended to give any "advice" it would be right here, and I should say "do not spoil you well-earned leisure of the afternoon in the vain attempt to do two days' work in one, for although the "mills of the gods grind slowly," retribution comes at last for *overwork*, as surely as for other sins. I know *this* from experience; so take a little time to see the roses blossom, and to enjoy the beauty of the summer, and if any one upbraids you for your idleness bear it patiently but *don't* be thus driven to overwork.

Some afternoon while sitting in your easy chair turning the pages of the last magazine, you may be startled by a sound indescribable to those who have never heard it, but the source of which you are certain. The bees are swarming. In half a minute you are in the midst of the roaring, buzzing, swaying mass, for your trained ear probably caught the sound before a quarter of them were on the wing, and your trained eye takes quick note of the hive whence they are issuing. That problem being solved you turn to the next, where are they going? If the queen's wings are clipped it is usually but a few minutes work to cage her securely, and settle it in your own way, for they are pretty sure to cluster wherever you choose to place her. If her wings are not clipped, wait a little. If you are

afraid of being stung, put on a vail, and watch carefully until you see some signs of clustering.

If the one who hives the bees is near home, they will probably light upon the lowest branch of the nearest apple tree. But with the perverseness of many other things in this world, if he is a good ways off, they will very likely go into the top of the highest tree in the immediate vicinity. At all events you have had the pleasure of hearing them and watching their circling flight, and I would rather miss many other summer sights and sounds, than the swarming of the bees.

It is an excellent accomplishment for a farmer's wife to be able to drive her own horse if occasion requires. We do not want to say a word about the neglect of the masculine part of the household to take us driving or visiting as it was their pleasure to do before we were farmers' wives, but there are times when we are in a hurry. We want to hear from the post office, or we want half a dozen things from the village grocery. Now I do not pretend to explain the mystery, but we all know that a woman can do these errands and get home in from one to two hours quicker than a man. That is one of the practical uses of the knowledge, and I doubt not that others will readily suggest themselves to you.

It has been said that a woman can drive a horse as well as a man until *something* happens. So to diminish the probability of accidents, it is well to be on friendly terms with your horse and things will be less likely to happen. And the friendship of a spirited intelligent horse is worth having. He will soon learn to come at your call, and neigh with pleasure if he hears your step. His very docility is an outgrowth of his attachment to you, and while you have unconsciously come to know his moods and habits, he has just as surely learned yours, so the understanding is mutual.

I think any woman who has habitually driven a horse like that will count it worthy of a few tears at least, if she is obliged for any reason to part with it.

But the long days of summer bring something beside sunshine and flowers to the farmer's home. The extra work of haying and harvesting will call for all the reserved force you have been able to store up in the early part of the season. The days are long, and the nights so brief one wonders if it really pays to try to get a little rest between the last chores at night and the early start in the morning. The eight-hour system is not yet adopted by the most successful farmers, for when the grass is ready to cut, and he knows the grain is ripening so fast, the harvest will *crowd* upon the haying, from the farmer's standpoint it seems of more consequence to secure his crops than to limit the day's work to a certain number of hours.

Of course this *push* and *hurry* makes extra work in the house as well as out of doors, and extra dinners and lunches, with early suppers interspersed with late ones when the exigences of the work demand it, with the numberless little things that require looking after at this season, make it the busiest and hardest time

of the year for the housewife. If only the weeds would not grow quite so fast in the garden, it would be a comfort. But the "pusley" pushes up as energetically as Jonah's gourd, and if one has anything of a conscience, it is hardly possible to gather the vegetables for dinner without stopping to pull a few handsful of this irrepressible weed.

If the canning, the preserving, the pickling and the city cousin *could* only wait until the weather was cooler, I am sure some women's lives would be longer and more comfortable, but the August and September heats usually bring them all. The canning and preserving *must* be done, and of course we are duly hospitable, and are glad to see the city cousins, and they are so enthusiastic over many things, it does us good. They find the morning *so* fresh after you have served their late breakfast, and the glass of milk *so* refreshing after their afternoon nap, and the cream is *so* delicious, and the piazza *so* cool, you think some day you would really like to enjoy it yourself for a few minutes. As a general thing they are like those lilies you may have heard of, "that toil not neither do they spin, yet Solomon in all his glory was not arrayed like *some* of these." Their cool summer silks, and dainty gloves, their French hats, and lovely fans, *do* brighten up the church wonderfully of a Sunday, and I hope we are duly thankful. But they are soon gone, and some day you are glad to see that the barns are filled to overflowing, and you say Harvest Home, with a happy heart, and are delighted to have things fall into easier ways again.

There is no good reason why a woman upon a farm should tie herself down to a treadmill round of daily duties, with never a thought beyond. If you have any special tastes cultivate them. It seems a pity for the piano to be always shut, and the book-case locked, simply because a woman is married. It is an old saying that where there is a will, there is a way, and in the busiest lives, there is some leisure. The life of most farmers' wives is apt to be a lonely one, especially in the outlying neighborhoods. So if you must be your own company it is worth while to make yourself *good* company.

The best magazines, the best papers, the best books are none too good for you. Ah, you say—it is the *cost* of them, we cannot afford such luxuries. I *have* known the price of a new bonnet, or a new dress to be spent in a book store, and the old bonnet, and old dress, did good service for another season. The body certainly did not suffer very acutely, and the mind gained new inspiration. It is infinitely better to sit down of an afternoon or evening with a good author than to fritter away your time in small talk and gossip. You may be shut out from some social privileges. You may even never know what Mrs. A. said to Mrs. B. about Mrs. C., but you can know if you choose, the latest discoveries in science, the most interesting accounts of travels, the most beautiful poems, and the finest romances. I have heard women apologize for spending the evening with their books or music in-

stead of work, for there seems to be an unwritten law with some that the *hands* must be busy every moment. Fancywork is well enough in its place, and restful too, sometimes, and it is good for us to see some bit of beauty growing under our skilful fingers, but it is not well to sacrifice ourselves for such perishable things as patchwork or embroidery. Let us have what Emerson calls plain living, and high thinking, remembering that the "*life* is more than meat, and the body than raiment." If we do not lay up treasures of mind and heart for our old age, it will soon find us bankrupt in all that makes life worth living. We shall be without courage, without faith in our fellow men and without sympathy with whatever is good and true.

What is or can be more unlovely than the afternoon of life, when one only mourns for the past, and imagines the good people are all dead, the good books are not written in this generation, and all worthy things generally are on the decline. Contrast this with the genial and sunny old age it is our right to choose. Be good and good for something, and we shall have no time for bewailing. The world wants workers. A thousand avenues of usefulness are open to us. At the very least we

> "Can make things shine,
> You in your little corner, I in mine."

That is something. When the long evenings of the winter round out the year to completeness, then in planning and carrying out the plans for social enjoyment you are only ruling in your own particular kingdom. A little while ago I heard, or rather overheard a conversation which I will venture to repeat on account of the lesson it may have for us. It was about a certain town not a thousand miles from here, and one person asked if "real estate was selling well there." "No," was the answer, "it is constantly depreciating." "Good farming town, I suppose," said the other—"Good farms" was the reply "but the farmers are selling out as fast as they can, and are leaving." "Much trade?" "No mostly goes out of town." "Ah," said the first speaker, "it is a manufacturing town, is it not?" The answer came rather reluctantly, "They manufactured 400 barrels of cider there last fall, mostly for their own use." Possibly, shall I say probably, that explained the rest, and if you as farmers' wives are ever brought face to face with such a problem as that, deal truly and faithfully with it I beseech you.

It I have not spoken at length of dark days, and blue days, of days when the work falls out of line instead of into line, it is not because I do not know them right well, but because they are the common lot of humanity and are are not peculiar to farmers' wives.

Yet I have never found a day so long but that it ended at last, nor so dark but that there was light somehere, and now in the quiet afternoon of life, I thank God for the lessons of faith, of patience, and of quiet endurance that I learned upon the farm. If

I have achieved anything it has been because of this school of experience.

When I hear the choir sing sometimes of a Sunday, about,

> "Sweet fields beyond the swelling flood
> Stand dressed in living green,"

I never hear the rest of the hymn, for certain fields that I know, come before me so vividly that I can see the buttercups and daisies nod, and can catch again the faint perfume of the wild strawberries. I hear the gentle plash and ripple of the river, slowly making its way among the bush grasses, and the saucy challenge of the Bobolink as he sits poised on a stalk of meadow lilies. I see again the gay soldier blackbirds with their epaulettes of scarlet flitting in and out of every tree top, and over all the fair picture hangs the tender blue of a June sky. I wonder if the land of Beulah, where Bunyan says the sun shines constantly, day and night, is indeed fairer than this.

THE CENTENNIAL OF JUSTIN MORGAN.

Read by D. W. Bliss, at the Royalton Meeting.

The past year was the centennial of Justin Morgan, founder of the great family that bears his name. Were he now living he would be just one hundred years old. For, although it has been generally supposed that he was foaled in 1793 and brought by his owner and breeder, from whom he took his name, from Springfield, Mass., to Randolph, Vermont two years later, in the fall of 1795, recent investigation shows that these dates are incorrect. He was foaled in 1789 and brought to Randolph in the fall of 1791. His owner, Justin Morgan, had moved from Springfield, Mass., to our neighboring town of Randolph in the spring of 1788, and three years from the next fall he returned on horseback to Springfield and brought back with him the little bay two-year-old colt that was to make the name of Morgan a household word throughout the land. In regard to his blood it is well established that the original Morgan horse was a son of True Briton, of which horse he was almost a counterpart save that he was not quite as tall; True Briton being the horse that was captured or stolen from the British General DeLancy, at Hartford, Conn., during the revolutionary war. True Briton was a son of Imported Traveler, who in turn was by Morton's Traveler, a horse that drew his origin by near and direct lines from the five famous Arabians, Byerly Turk, Curwen's Bay Barb, the Lowther Barb, Bloody Buttocks, and the Godolphin Arabian Traveler (which latter although classed as a thoroughbred was an almost typical Arabian); and Justin Morgan in form, size, build, disposition, speed, strength and endurance, showed his close relation to the kings of the desert.

The first and hitherto only history of the Morgan horse and his progeny was an excellent book, now quite rare, written by the

late D. C. Linsley, and published in 1857. The following description of the horse, drawn by Mr. Linsley from the testimony of many who had known him well, is doubtless the best that exists:

"The original, or Justin Morgan, was about 14 hands high and weighed about 950 pounds. His color was dark bay with black legs, mane and tail. He had no white hairs on him. His mane, and tail were coarse and heavy, but not so massive as has sometimes been described; the hair of both were straight and not inclined to curl. His head was good, not extremely small, but lean and bony, the face straight, forehead broad, ears small and very fine, but set wide apart. His eyes were medium size, very dark and prominent, with a spirited but pleasant expression, and showed no white round the edge of the lid. His nostrils were very large, the muzzle small and the lips close and firm. His back and legs were perhaps his most noticeable points. The former was very short, the shoulder blades and hip bones being very long and oblique, and the loins exceedingly broad and muscular. His body was rather long, round, and deep, close ribbed up; chest deep and wide, with the breast bone projecting a good deal in front. His legs were short, close jointed, thin, but very wide, hard and free from meat, with muscles that were remarkably large for a horse of his size, and this superabundance of muscle exhibited itself at every step. His hair was short and at almost all seasons soft and glossy. He had a little long hair about the fetlocks and for two or three inches above the fetlocks on the back side of the legs; the rest of the limbs were free from it. His feet were small but well shaped, and he was in every respect perfectly sound and free from any sort of blemish. He was a very fast walker. In trotting his gait was slow and smooth, and his step short and nervous; he was not what in these days would be called fast, and we think it doubtful if he could trot a mile much if any within four minutes, though it is claimed by many that he could trot it in three.

"Although he raised his feet but little he never stumbled. His proud, bold and fearless style of movement, and his vigorous, untiring action, have, perhaps, never been surpassed. When a rider was on him, he was obedient to the slightest motion of the rein, would walk backwards rapidly under a gentle pressure of the bit and moved sideways almost as willingly as he moved forward; in short was perfectly trained to all the paces and evolutions of a parade horse; and when ridden at military reviews (as was frequently the case), his bold, imposing style, and spirited, nervous action, attracted universal attention and admiration. He was perfectly gentle and kind to handle, and loved to be groomed and caressed; but he disliked to have children about him, and had an inveterate hatred for dogs, if loose always chasing them out of sight the instant he saw them. When taken out with halter or bridle he was in constant motion and very playful.

He was a fleet runner at short distances. Running horses short

distances for small stakes was very common in Vermont fifty years ago. Eighty rods was very generally the length of the course. * * * Among the many races of this description that he ran were two in 1796, at Brookfield, Vt., one with a horse called Sweepstakes, from Long Island, and the other with a horse called Silvertail, from St. Lawrence county, New York; both of these he beat with ease, Mr. Morgan who then owned him offered to give the owner of Silvertail two more chances to win the stake, which was fifty dollars, by walking or trotting the horses for it, but the offer was declined. * * *

"In harness Justin Morgan was quiet but full of spirit, an eager and nimble traveler, but patient in bad spots; and although for a long time steadily engaged in the heavy work of a new farm, his owner at that time informs us that he never knew him to refuse to draw as often as he was required to, but he pithily adds: 'I didn't very often have to ask him but once, for whatever he was hitched to generally had to come the first time trying.' This uniform kindness at a pull was one of the striking characteristics of the horse, and the same trait may be observed in the greater part of his descendants. Pulling matches and pulling bees were as common in those days as short races, and the little horse, as he was often called, became quite celebrated for his unvarying willingness to do his best, and for his great power at what is called a dead lift." Mr. Linsley also inserts a long letter from Solomon Steele, who seems to have known the horse well, and who says among other things, that he could out-draw, out-walk, out-trot and out-run every horse that was ever matched against him.

It will be seen that this athlete among horses was made up in the same way, and had the same characteristics as the typical Morgan of the present day. We expect now materially increased size and more speed at the trot but in all other points a worthy descendant of the line will strongly resemble the father of the family. It is this power of the sire to reproduce his own qualities in his off-spring and carry them down to future generations, prepotency, as it is now termed—that has made the Morgan family at once so valuable and so distinct. And the power itself doubtless comes from the strong Arab breeding of the original Morgan. No line of horses in the world has been kept so pure for such a length of time as the Arab; and none can be reproduced with such uniformity. They have established their type; they breed horses with as much uniformity as we breed fowls; and the type is so firmly established that it will prevail over a very large infusion of mixed blood. This I believe to be the reason why a horse that carries only a small fraction of Morgan blood will frequently exhibit in a very marked degree the Morgan characteristics.

If I were to select a representative Morgan of my own acquaintance, I would name Motion, 2:29, son of Daniel Lambert; and one would be surprised to note how closely the description of the original would apply to him, except in the matter of color and speed. Motion was a trifle larger than Justin Morgan being 15

hands high; but he had the same athletic development, high finish, lofty style, resolute disposition and determined courage; the same high head and flowing mane and tail; in fact the same Morgan points from nose to heel, that Mr. Linsley has described. Before I took him he had a reputation for bad temper, but as soon as we were acquainted he was perfectly gentle in my hands, and I have no doubt but that his temper was only the resentment that every intelligent and courageous animal will show at bad treatment. He was a horse of wonderful speed and could, before he was taken ill that summer, pull a road wagon a 2:20 clip.

Mr. Morgan owned the original Morgan horse nearly up to the time of his own death, which occurred in March, 1708, when the horse was nine years old. Mr. Morgan used the horse mostly as a riding horse, though he broke him to harness and used him occasionally in that way. In the summer he stood the horse up and down this valley from Randolph to White River Junction. In the winter Mr. Morgan, used to ride the horse in his business which was that of a singing master. It it is said also that he kept him one season near Burlington. He also let him one year to Robert Evans, of Randolph who used him as his only team in clearing a lot of new land; and throughout his life the horse was constantly doing useful work, and at times received rough usage. He passed from Mr. Morgan to William Rice, of Woodstock, who kept him two or three years, till about 1801 when he sold the horse to the same Robert Evans, of Randolph, who had hired him of his original owner. Evans kept him three years and then in 1804 traded him to John Goss, of St. Johnsbury, through whose hands he passed almost immediately to David Goss, of St Johnsbury, a brother of John, who kept him seven years, till 1811; from his ownership the horse took the name of the Goss horse, a name by which he was always afterward more or less known. In 1811 David Goss sold the horse, now 22 years old, to his son Philip, who took him back to Randolph, where he was kept awhile by his old owner, Robert Evans. After this the old horse changed hands rapidly. In the fall of 1811 Philip Goss sold him to Jacob Sanderson who in turn sold him to a Mr. Langmade, who used him hard, working him in a six-horse team hauling freight between Windsor and Chelsea. He afterward passed into the hands of Joel Goss, of Claremont. New Hampshire, who kept him in that vicinity at least one season and probably more. Goss sold him to Samuel Stone, of Randolph who kept him till 1819, when he in turn sold him to Levi Bean, of Chelsea, in whose hands he died at the barn of Clifford Bean about three miles south of Chelsea village, in the winter of 1821, being then in his 33d year. Old age was not however, the immediate cause of his death. He was not stabled but was running loose in the yard with other horses from one of which he received a kick on the flank; being without shelter and exposed to the rigors of a Vermont winter, inflammation set in and the old horse died. Before receiving the hurt which caused his death he was perfectly sound and free from any blemish. His limbs were perfectly smooth,

clean, free from any swelling, and perfectly limber and supple. Those who saw him in 1819 and 1820 describe his appearance as remarkably fresh and youthful. Age had not quenched his spirit nor dampened the ardor of his temper; years of severest labor had not sapped his vigor nor broken his constitution; his eye was still bright and his step still firm and elastic.

Mr. Linsley ends his description of the old hero with these very just remarks. "However various may be the opinions different persons may entertain respecting the merits of Justin Morgan we doubt whether any horse can be instanced in this or any other country, that has so strikingly impressed upon his descendants, to the fifth and sixth generation, his own striking and valuable characteristics; and it may be safely asserted that the stock of no horse ever bred in this country has proved so generally and largely profitable to the breeders of it. The raising of it has made the fortunes of hundreds of individuals, and added hundreds of thousands, if not millions of dollars to the wealth of Vermont and New Hampshire."

These statements are as true to-day as when they were written thirty-three years ago; although in that period the fame of the Morgan horse had suffered an eclipse, but has again come out shining with more than its original brightness. The eclipse was from two leading causes; first we were quite too apt to sell the best and keep the poorest to breed from; a course that only requires time to run out the best stock in the world. And secondly, the world of horse literature was for a long time against us. One can hardly realize what a power this much laughed at agency, horse literature, can be. It is quite certain that the owners of the rival family, the Messengers, nearly succeeded in driving the Morgans out of the world with it. They so filled the country with the idea that all trotting speed came from Messenger, that people were suppressing the Morgan strains, ten years ago, as fast as possible, in every trotting pedigree. This was purely a literary effort, organized at New York, the home of the Messengers, and gradually spreading over the whole country. It is different now, and that it is so is largely due to the fact that the same agency is now at work for the Morgan; the press stands up for him now all over the land.

Trotting speed came from imported Messenger in the male line, through only one channel—Bay Mambrino was his only son that founded a trotting family. Justin Morgan, only seven or eight of whose sons were kept entire, as against over fifty of Messenger's —Justin Morgan left three sons that founded trotting families, Sherman, Woodbury and Bulrush. Sherman was foaled in 1809, Bulrush in 1812 and Woodbury in 1816, Sherman being foaled the spring his sire was 20 years old, and the two others having been got after he had passed his twentieth year. Sherman was the smallest and has become the most distinguished of the three. He was bred by James Sherman, of Lyndon, Vermont; was a bright chestnut, less than 14 hands high and weighed 925 pounds;

his off hind leg was white from the foot half way to the hock, and he had the thin wandering white stripe in the face now so characteristic of his descendants in the famous Lambert family. Woodbury was the largest of the three, being about 15 hands, and weighing, at his heaviest 1,040 pounds. He was a rich dark chestnut and was marked almost precisely like Sherman, save the stripe in the face was broader, filling the space between the nostrils; he had the same off hind leg white half way to the hock. He was bred by William Wight, of Tunbridge and was owned for many years by John Woodbury, of Bethel. Bulrush was about middle way in size between the other two, and unlike them, was a dark bay in color with no marks save a few white hairs on the forehead. He was bred by Moses Belknap then of Randolph the grandfather of Creighton Belknap now of Royalton. The blood of the dam of neither of these distinguished sires has ever been ascertained. They were very much alike in their characteristics and all very like the sire. They had the same compactness of form, great muscular development, hardy, rugged constitution, docility and tractableness, short, easy, rapid step, eager ambition and lofty courage, that were so remarkable in their sire. Through these noble channels the blood of Justin Morgan was poured profusely into the then hardy stock of Vermont, conveying not only the form of the great original but all his unrivaled vigor, grace and ease of motion, combined with his docility and matchless courage.

The Morgan is pre-eminently a useful horse, and it would not detract greatly from the real merits of the family if no member of it had ever stepped his foot upon a race track. But it so happens in our day and generation that about the only quality of a horse that we can really measure and define is his ability to trot a measured mile and repeat. And it is the horses that are engaged in doing this that are heard of, and get a place in the paper or book. The Morgans are to-day the best roadsters in the world; that would seem to be glory enough for one family. But they have such a way of going to the front in whatever they are called on to do that it is a further fact that they have been very successful on the trotting track as well. They have not been bred as have the Hambletonian family, with the express intent to get fast trotters for track purposes, but from the ranks of the gentleman's roadsters that have been produced in the Morgan family have been obtained from time to time some of the very fastest and gamest trotters that have ever graced the American turf. From Sherman came his great son Black Hawk, a fast trotter for those times and no doubt the most perfect road horse of his day. He was the sire of Sherman Black Hawk that got Vermont Hero, which in turn sired Gen. Knox that went to Maine and established there a great road and trotting family of that name. Sherman Black Hawk also got King Herod, that went west and there established a family of that name that has furnished some star performers. But by far the greatest of the get of Vermont Black Hawk, was the famous bay beauty, Ethan Allen, a horse that the whole country used to

go wild over, so swift and beautiful was he. Black Hawk was foaled in 1833; his great son, Ethan Allen, in 1840. The dam of Ethan was bred by John Fields, of Chester. She was a small, highly finished gray mare, foaled in 1830, got by a small and very fine bay horse called Robin, or Red Robin, whose breeding has not been traced. The dam of this gray mare was a small brown mare bred by John Fields and almost certainly an inbred Morgan, the best testimony being that she was a daughter of Woodbury from a dam by Justin Morgan himself. Ethan Allen, in form, carriage, color, docility, intelligence and courage was so far a counterpart of the original Morgan that students of the blood, at the head of whom stood and still stands, Joseph Battell, had long disbelieved the manufactured story that this famous gray mare, the dam of Ethan was by the Freeman Messenger, and felt a strong assurance that when she should be traced she would be found to be of Morgan origin. After an expenditure of months of time and hundreds of dollars in search, Mr. Battell at last succeeded in tracing her to her breeder, and getting a full history of her from her birth to her latest day. The utmost endeavors have, as I am informed, as yet failed to ascertain to a certainty what horse got the little beautiful bay, Red Robin, her sire, who is described in the words of a man who owned and broke the dam of Ethan: "Red Robin was as beautiful a horse as you ever saw, as supple as a fox, as beautiful as Ethan Allen who looked very much like him." Red Robin was bred down on the Connecticut River, at Weathersfield Bow, at a time when Justin Morgan himself stood just across the bridge in Claremont, even if he did not, which is more than probable, have a station also on the Weathersfield side. So Red Robin had at least as good an opportunity to be a son of the original Justin Morgan as of any other horse. Mr. Leland, who was the first purchaser and breaker of the gray daughter of Red Robin that was the dam of Ethan, and who knew the horse well and describes him perfectly, is very positive that Red Robin was called a Morgan. His size, color, build and characteristics point very strongly to that origin; but it is not proven and the most we say is that the dam of Ethan Allen, was got by Red Robin, probably a son of Justin Morgan, by a dam that was almost certainly an inbred Morgan mare.

From this little gray mare, crossed with the horse that was then and always the greatest grandson in the male line of Justin Morgan, Vermont Black Hawk, was born on the 18th June, 1849, just 60 years after the birth of the founder of the family, Ethan Allen, almost a counterpart of Justin Morgan himself save that he was about an inch taller, and had that astonishing trotting speed that his great ancestor, if he ever possessed it, never had an opportunity to show. I can do no better than to describe him in the graphic language of S. W. Parlin, of the American Cultivator.

"No one ever raised a doubt as to his being the handsomest and most perfectly gaited trotter that has ever been produced. Horsemen will agree that no trotter has ever appeared upon the turf that

excelled him in the style and beauty of his action, whether moving at a jog or flying at the rate of a mile in 2:15. His trotting instinct was wonderfully strong and his disposition the best imaginable, two qualities which enabled him, when hitched with a running mate, to outstrip every competitor that could be brought against him in that rig. During the season of 1861, hitched with a runner, he won three races from the world-renowned Flora Temple, rigged in the same style, in one of which he placed his mark at 2:19¾. In May, 1867, at the Union Course, Long Island, he beat Brown George and running mate in straight heats, time, 2:29, 2:21, 2:19. The crowning event of his life, however, was the race in which, hitched with running mate, he challenged the admiration of the world by defeating the mighty Dexter, which was then supposed to be invincible, at the Union Course, June 21st, 1867, in short order, landing at the wire in 2:15, 2:16 and 2:19 respectively. Good judges estimated him capable of trotting the first heat in 2:12 had he been sent with that intention."

This closes Mr. Parlin's description. It will be noted that at the time of this supreme effort, Ethan Allen was 18 years old. He had been upon the turf more or less nearly every season since he was two years old. But the campaigning was not the worst of it. He had been twice poisoned to prevent his winning, and that, too, by his breeder and joint owner, the rascally Joel W. Holcomb, who poisoned his own beautiful horse that he might beat his own partner at the pool box. These great performances, and greater abuses did not so far drain the vitality of the wonderful little bay, as to prevent his turf period from extending over twenty years, a longer period than that of any other trotter that ever lived, nor did they prevent his being one of the most successful winners of his day. But they interfered sadly with his stud career, and doubtless prevented his getting, late in life, the high quality of offspring which he otherwise would have gotten. This is illustrated by the fact that in the year 1857, after he had become known to the public and before his powers had been impaired, he got the four famous stallions, Holabird's Ethan, DeLong's Ethan, American Ethan, and Daniel Lambert, a quartette that for twenty years as roadster sires stood unrivaled in the world, from each of which has sprung a family of trotters, and one of which, Daniel Lambert, held for many years the proud position of greatest living sire of trotters, as measured by the 2:30 list. Three I think are still living, and all four were living, and vigorous at 31 years of age. Had old Ethan been handled as was Rysdyk's Hambletonian, born of a great rival family the same year, and passing into the hands of a man who developed a genius for advertising him, and kept him before the public for the same period, never trotting him a race, and in fact never knowing that he could trot a race, but producing with him over 1,300 foals, a large share of which among the males were kept entire; if Ethan had been so handled, we should have had Daniel Lamberts by the dozen, and Holabird's Ethans by the score, and the trotting tracks of the present day would be adorned

not only with the swiftest, but with the most stylish and beautiful line of harness horses in the world. The people do not forget their old-time favorite; and I will close this already too long description, with the apostrophe of a recent writer addressed to the memory of this wonderful horse.

"Remember thee, thou king of the Morgans! The green grasses of her summer will wither into ashes, and the snows of her winters will melt under the fires that bring the end of the world, before the sons and daughters of Vermont will forget thee, thou Eagle of her hills; thou Pride of the Green Mountains."

Time will forbid my dwelling on the descendants of Ethan Allen. They are well known through a number of different channels, the most noted of which is Daniel Lambert. This great sire of speed and beauty, was one of the very few sons of Ethan that had what was called a fashionably bred dam. His dam was by Abdallah, son of Mambrino, and sire of Rysdyk's Hambletonian; and his second dam was by Stockholm's American Star, son of Duroc, by imported Diomed. Still Lambert was in all his essentials a Morgan, scarcely larger than his sire, and in style and beauty rivaling even him in his prime. He was a rich chestnut in color, with left hind ankle white, and the characteristic stripe wandering down his forehead. His mane and tail were abundant, fine and flaxen. He had a three-year-old record of 2:42, and was considered the fastest three-year old of his time. He is now represented by 34 performers in 2:30 or better, and has many producing sons and daughters. His two sons, Aristos and Ben Franklin, led New England in their additions to the 2:30 list the last season, Aristos having five and Ben Franklin four new comers. The only other sire in New England having four was Alcantara, but two of his were got in Kentucky before he came north.

Leaving here the most interesting and distinguished line of the Morgan family, I turn to the Bulrush branch, which, as I have said, also produced trotters. Bulrush himself was probably the fastest trotter among the sons of Justin Morgan, but his speed did not crop out so as to get into the records as early as it did in both the other branches. Bulrush got a little bay horse, very much like himself that was kept at Randolph, and called the Randolph Horse; the Randolph Horse got the Jennison colt, a large but very finely finished animal, and he in turn got old Morrill, founder of the family of that name. Old Morrill was a handsome brown horse, 15½ hands high, and of strong build, something of a trotter himself, and sire of two in the 2:30 list. But his fame rests upon the success of his son, Young Morrill. It is not known that there was in old Morrill any infusion of Morgan blood except what came in a direct male line, and it is noticeable that the son that was to be in reality the founder of the Morrill family was from a Morgan dam, thus getting the first reinforcement of the old blood. The dam of Young Morrill is given by Linsley as a daughter of Sherman. Young Morrill was a little taller than his sire, being about 16 hands; he was also a very substantial brown horse of much

style, and for some years deemed the champion trotting stallion of the State, though his best public record is 2:31; there is no doubt, however, that he was much faster than those figures indicate. He was a very remarkable fountain of trotting speed. From a dam of strong Morgan breeding he got Winthrop Morrill, that went to Maine, and there established a family second to none for road work, and second only to the Knoxes as trotters in that Commonwealth, famous as it is for fine horses. From the mare Old Scrog, he got the elegant trotting stallion Draco, owned several years by the late Leonard T. Tucker, of Royalton, that achieved a record of 2:28¼; and Draco in turn from the Ansel Burbank mare by Furman's son of Black Hawk, and interbred and intertwisted to the Morgan blood on her dam's side a dozen times over—from that mare Draco got the famous Draco Prince, whose record of 2:24½ has remained the best Vermont stallion record from that day till the past season, when it was beaten by the 2:23½ of Gillig, the great four-year-old son of Aristos. But the greatest of the get of Young Morrill was the superb brown stallion, Fearnaught, whose record of 2:23½ when he took it, and with it the ten thousand dollar purse at Buffalo, was the fastest stallion record in the world. The dam of Fearnaught was also inbred to the Sherman line of the Morgan family; she was a daughter of Napoleon, he by Flint Morgan, son of Sherman. Fearnaught has founded a distinguished trotting family, among which the most noted sire is Royal Fearnaught, son of Fearnaught, that with no advantages save the Morgan blood prevalent in the mares about his home in Coldwater, Mich., has at sixteen years of age, if I am correctly informed, 14 performers in 2:30 list, the fastest of which is Silverthread, 2:15. Now you will notice that as we come down from old Morrill, our line has kept improving; Young Morrill better than old; Draco better than Young Morrill; and Draco Prince better than Draco. But Young Morrill had more than double the Morgan blood of his sire, Draco had more yet, and in Draco Prince it was again doubly intensified. Coming down the Fearnaught branch, we find the Morgan blood of Young Morrill intensified by a stream from Sherman through his dam; and passing from that great horse to his greatest son, Royal Fearnaught, the greatest sire of his age in the Morgan family, and one of the greatest in any family, we very curiously find the Morgan blood again intensified, and from a source very near home. For the dam of Royal Fearnaught was given one of those pedigrees so easy to manufacture, and so handy to get recorded in the *American Trotting Register*, that grasped at any thing at that time, asking no questions, provided the pedigree came from this region, and claimed no Morgan blood. She was recorded as by old Columbus, and her dam, of course, by Harris' Hambletonian, and so she has ever since been given. But within a few days Joseph Battell publishes the fact that the dam of Royal Fearnaught was bred here in Royalton, and got by Draco himself. One who has seen the evidence tells me that there is no possible mistake about this tracing; and so we see in this famous

young sire, an inbred Morrill, having for his sire the very best son of Young Morrill, and for his dam a daughter of the next best son of the same horse, and not one particle of trotting blood known to course in the veins of either branch of this pedigree, save what is drawn through a score of channels from Justin Morgan.

This is a fairly good illustration of how horse literature has been used to rob the Morgan family. I have before mentioned the "dam by Freeman Messenger," that was kindly invented and tacked on to Ethan Allen as soon as he was found to be able to trot the gamest and handsomest race that the world had then ever been treated to. I might refer also to the case of Gen. Knox, who no sooner began to be distinguished, than he appeared in the *Trotting Register* with his own dam and that of his sire, both by the inevitable Harris' Hambletonian, who being about the only Messenger then up this way, was called in to officiate as sire or grandsire, or both, of about all horses that showed a capacity to trot; it is needless to say that this pedigree was bogus, the dam of Gen. Knox being by Searcher, son of Barney Henry, and his second dam not traced. Yet the compiler of the *Register*, the same man who holds the position now, tabulated the pedigree and used it in an elabrate preface to one of the volumes of that work to show that the "little short, spluttering-gaited Morgans" could never produce a trotter unless the blood of a Messenger came in in sufficient abundance "to lengthen the strides and give the staying power." These steals have now been mostly traced up, and there are scores of them; they will not be apt to be corrected in the *American Trotting Register*, as they are not there for the purpose of correcting mistakes purposely made, but we are about to have a Morgan Register, gotten up on the plan of asking no one to take anything on trust; the breeder's name, and address, of every animal given as ascertained in every pedigree, will be given, and every reader can investigate and verify for himself. It is the suppression, or what is the same thing, the ignorance of breeders' addresses, that has enabled the *Trotting Register* to foist upon the country such a cargo of bogus pedigrees, and enabled its manipulators to build up one family at the expense of all others. Well, I was going to cite the case of the Morrills. The work was begun by giving old Morrill a Messenger dam, thus—"dam by the Farrington horse, by the Vance horse, by imported Messenger." This was not enough, and they made a determined effort to disprove the getting of old Morrill by the Jennison colt, and undertook to make him out by another horse, to which they had fastened a bogus Messenger pedigree. This so stirred up our then townsman, L. T. Tucker, owner of Draco, that he went up to Danville, where old Morrill was owned and bred, and in a day or two had all the evidence necessary to show the breeding as originally given, and to show that no one at that time knew what the blood of the Vance horse was; it has since been ascertained but not yet published; it is sufficient to say that he was in no way related to Messenger. This evidence Mr. Tucker published at the time, and it was sufficient

to settle the matter for many years, when, supposing it had been forgotten, some three years ago the old lies were revived, and got into so honest and unusually right-minded paper as the *American Cultivator*, which, however, as soon as Mr. Tucker's evidence was forwarded to it, published the letter and explained the fraud in full. I do not know as they attacked the pedigree of Young Morrill; but no sooner had Fearnaught in the hands of that wizard of the sulky, Dan Mace, achieved his tremendous success at Buffalo, and been bought by Col. H. S. Russell, of Milton, Mass., and put into the stud, than the gang began on his pedigree. It was gravely stated that he was not got by Young Morrill at all, but was a son of a horse (presumably of Messenger blood) called Wild Irishman. It so happened that the breeder of Fearnaught was living, and an affidavit from him with a copy of the receipt for the service fee, accompanied by one from the owners of Young Morrill with the book entry was sufficient to discourage them on this line. Being fought out of the pedigree business, the scamps hired a cheap literary scrub named Spencer Borden, of Fall River, who wrote under the unpronounceable nom de plume of Yah Amerikanski, to go up to Col. Russell's place, and into New Hampshire, where the dam of Fearnaught was owned, and write up a series of scurrilous articles, abusing Fearnaught, his get, his dam, his sire, and everything connected with him in the most shameful way; and these interesting papers were all published in *Wallace's Monthly*, to its lasting infamy. But Col. Russell, who had a choice lot of brood mares, kept on breeding to Fearnaught; and the third year that he had him, at the early age of fourteen, the horse mysteriously died, whether helped out of the world by the same gang that had dogged him so persistently for years for the crime of being a Morgan winner, or not, history does not say. And now, as we have seen, the same kind of false pedigree has been attached to his greatest son, on the dam's side, and has been recorded by the same interesting fellow that published the scurrilous articles about his sire.

People inquire what we want of a Morgan Register. There are a score of reasons that I will not mention; but if there were but the single reason that as long as we do not have one we must submit to such treatment from the New York clique as I have just been reciting, that alone would be amply sufficient. For, as I have said, the influence of this systematic roguery cannot be estimated. This literature was the best accredited in the country. The editor was the official Register of the National Association. The consequence was that these lies not being shown up were almost universally believed. Think how it must have changed the plans of those even most favorable to the Morgan family. It could be shown by the records, by reputable and recorded pedigrees, that it was impossible to get a speedy horse that should be Morgan on both sides. The result was that the most intelligent and thoughtful breeders, those that form public opinion and have a large following, would not breed a Morgan mare to a Morgan

horse; and so the whole current of breeding was changed, and it is only now that we are getting back to the facts; the current was changed by this mass of lies, told in their own interest by those who had a stock not so good as ours, as they knew, and yet a stock they wanted to sell us, and did sell to us for inordinate prices, to take the place of our own. I know something of it. I went through the mill. I believed these lies for a long time. I have a fine mare that I have bred to the three best sons of Rysdyk's Hambletonian, with one exception, that have ever been in this State. I got three fillies, not one of which was ever, so far as I could get offered, worth $200. I took the same mare to the Morgan horse Ben Franklin, and got a colt that I sold when he was coming four for $1,000, and I learn that his present owners have refused $2,500 for him. I then began to get my eyes open, and our breeders throughout the State are all, or nearly all, having a like experience. The very best colts, and those most sought by purchasers, shown at our recent breeders' meetings, have been inbred Morgans; such as Peerless Ben by Ben Franklin out of a dam by Holabird's Ethan, and Claremont by Lambertus, out of a dam by DeLong's Ethan. And yet it is only for a short time that our breeders have dared to breed that way. They will do so more in the future, as the demand for colts to go west and get dams for the next generation of trotters is for a strong outcross, and the Morgan colts most sought are those that are Morgan on both sides.

But I am making this too long. I do want to say a word of the descendants of Woodbury. The first Morgan trotters were Woodbury's. Lady Sutton, the first mare but one to make a record in 2:30 was by Morgan Eagle, son of Woodbury Morgan. This Morgan Eagle got a son of his own name that wandered off to Coldwater, Michigan, and there got the famous sire, Magna Charta, that has there founded a family of trotters, and is still more renowned as sire of the dams of trotters. The distinction is his of getting the dam of the beautiful bay gelding Jack, 2:15, that at Lexington last fall won in three straight heats over such stars as Nelson, 2:14, and Alcryon, 2:14½. This Nelson, by the way, is related to Royalton; the dam of his sire, Young Rolfe, was by old Draco, and it is now asserted with great confidence that the third dam of Axtell, 2:12, the mighty three-year-old that wears the stallion crown, was by the same sire. But to return to the Woodburys. The first gelding that ever trotted a mile in 2:30 was Beppo, by Gifford, son of Woodbury Morgan. From Gifford has sprung a royal trotting family. He got the Barnard Morgan that in turn got Vermont Morgan. Vermont Morgan was taken west and passed into the hands of L. L. Dorsey, of Louisville, Kentucky; there the two streams of Arab blood were reunited, as Vermont Morgan was coupled with a daughter of the imported Arabian Zilcaadi, and the produce was Golddust, one of the finest horses that ever stood on iron. The Golddusts are now a well known trotting family; the old horse had a short career in the

stud and that broken up by the war; but he got a line of trotters and trotting sires that are not to be overlooked. The fastest of his get was the elegant mare Lucile Golddust, that won a record of 2:16 when that was among the fastest, and has since added greatly to her laurels by producing two trotters, Lucile's Baby and Sprague Golddust, both of which have records better than 2:20. No other mare with as fast a record has ever produced two as fast; but the Morgans are long-lived and hardy wherever they are, and they do not wear out.

There is plenty more to tell, but the subject is too big for a single paper, and thanking you for your patience, I will close by hoping that no breeder will ever be deterred from breeding Morgans because some one interested in a different line thinks it not advisable.

FARMING IN ADDISON COUNTY.

Read by C. R. Smith at the Addison meeting.

This has been justly styled "a wonderful age." Never in the history of the world has civilization made such gigantic strides as within the past quarter of a century. Invention has followed invention, and the march of improvement has been so rapid we have almost ceased to be astounded by the most marvelous discoveries, or incredulous as regards what those who prophesy, predict will yet be done in the way of invention. Indeed, looking backward on the wonders already accomplished, we are not inclined to pronounce their statements to be impossible, even if we deem them extravagant and improbable. Wagons and farming machinery propelled by electricity are among the things looked forward to by these knowing ones, who, by the way, might possibly become more energetic farmers if a little electricity were infused into their speculative systems.

Now are we, the farmers of Addison county, keeping pace with the times, is a question each one of us may with great propriety ask himself. And I doubt if any one of us can truly reply that we are doing even as well as we know how. We find it extremely difficult to throw over the rules laid down by our grandfathers and adopted by our fathers, after we know they are not the methods that are at present most approved by our more progressive farmers.

It has been erroneously supposed that any one could become a farmer, and a few still profess to believe that all it requires to make a good one is main strength and a certain amount of pigheadedness. This is not the case; a man may show as much enterprise, energy, and order-lines in farm work as in *any other kind.* Indeed, of all ways of making a living, profitable farming seems to me the most intricate. It is a pursuit in which intellect, when pitted against strength, comes out almost invariably ahead. The science of agriculture in all its departments has never been mas-

tered. A man may become proficient in one line, and still leave whole fields unexplored. Men of giant mind may spend their lives in diligent study and practice, and then have failed to understand the half that may be told. The man who would become a good practical farmer, should begin life on a farm when a boy, and become familiar with all the details that go to make up a farmer's work. It would be presumption on my part, in a gathering of such a character as this, among such a body of men, to presume to lay down instructions whereby you may become more expert in the business of farming; you would have a right to think me presumptious if I undertook to inform *you* how to breed sheep, who have won a world-wide reputation, and are the very center and fountain-head of that industry. A man who cannot tell a spavin from a ringbone should be the last one to enlighten the people of a county so celebrated for the speed, endurance, the *perfectness*, of its horses. Shall cattle be the topic, when I have raised nothing but grades. Bees have never been on friendly terms with me, though the quality of honey produced is of superior excellence. I have had larger experience in testing maple sugar than in manufacturing it. So I shall content myself with mentioning a few things which ought to be remedied, and some comments upon what may be called the talk of the times.

In regard to politics, we farmers are too apt to let the nominating caucuses and conventions go by without attending or giving them a passing thought. Its too much *trouble* to us to attend, besides we know that the programme is all cut and dried beforehand by the ring in the village or county; this is too often true and accounts in a measure for the number of professional men holding office in counties where the farmers are largely in the majority. We ought to vote intelligently and honestly for the most honest and intelligent candidate, regardless of party politics. The time has come when we should come to the front, make our influence felt, and no longer vote the straight ticket regardless of the position some of the candidates may hold toward the farming interests.

For the last number of years the Tariff has been the all-absorbing topic for discussion in political meetings. One party politician comes along and "whoops 'er up" for a high tariff; the next day the opposing party candidate comes and whoops 'er down for a low tariff. Both are perhaps honest in their convictions, and make able arguments for their respective parties, each apparently proving that that which looks like exactly different policies is best calculated to advance the interests of that particular section. It's all tariff, tariff, tariff, till I've almost concluded, though you dub me a heretic, that the whole thing is like the old woman's remedy for every illness, "Slippery Elm Bark": for chills and fever she scraped it up, and for consumption and dysentery she scraped it down, but 'twas all slippery elm bark.

Be an independent voter, an aggressive politician; support the best man and you will not do far from the proper thing. Never before in the history of American agriculture has the attention of

farmers been so generally directed to the improvement of what may be called the business side of their occupation. Our business may perhaps be said to lie in two lines, that of producing and that of disposing of the products of our farms. It is evident that we have made greater progress in the raising of crops than in their sale. The attention of this Board of Agriculture, as well as most agricultural societies, has, until recently at least, been almost entirely directed to teaching us how to raise better crops. The old saying was that "a crop well raised was half-way to market." But in these days of combination and competition this hardly holds true.

Our papers speak of boards of trade, butter and cheese exchanges, fruit unions and tobacco trusts that are being organized, and that they work successfully. This indicates that there are changes to be witnessed in the business of farming, which within the next few years will secure better prices by reducing the expenses between the producer and consumer. Farmers demand better prices, and we have only to look at the present system to see wherein a saving should be made. Our older farmers may begin this reform, but it is the rising young men who will bring the plans already begun to final perfection. And our agricultural colleges should give special instruction in this important yet neglected branch of farm business.

There is a tendency among us to follow the lead of any one who has made some specialty a success. Our neighbor has grown "*well off*" raising merino sheep, so all of us go into that business whether we are adapted to it or not; we find we can raise them well enough, but the trouble is to sell, and the venture fails. There are some men who live not many miles away who would go a mile out of their way to kick a merino sheep.

A man may try some special crop, such as cabbages, early potatoes, onions, or strawberries. The near-by markets enable him to realize a good profit, but his neighbors conclude it would be well and easy to do likewise, and while the industry adopted might yield exceptionally good returns to a few who are especially fitted for it, the great number engaging therein causes a large supply and results in a glutted near-by market, and consequently no profit for any one. I have known men to make a complete success of some line of business and his neighbor as complete a failure, because of the lack of information concerning the work. Knowledge and experience is just as valuable to him as the knowledge of the doctor or lawyer. Farmers often fail for this reason, but still more often for lack of industry. Farmers are like fowls —neither will get full crops without industry; for the "swine get the most swill that nose most."

Success cannot be achieved here or elsewhere by following obsolete methods of gathering crops, or keeping herds of dairy cows of which one-half do not give a profitable amount of milk. We need to produce all we can at the least possible cost.

An impression has existed that the occupation is degrading, and

affords no chance for ambitious young men to gain an honorable position among their fellows.

This idea never originated with our men of mind, with our pure and noble women, the true nobility of the land, but rather with the opposite extreme of society, that self-styled aristocracy, who, while possessing wealth and affluence, are bankrupt in mind and moral worth.

We must admit that many who till the soil are unfitted for the work. Circumstances have made them farmers, and, as a class, they are poorly paid, overworked, and frequently isolated from the world; but much of this is the result of ignorance or stupidity, and casts no reflection on the work itself. There are ignorant and stupid men in other callings as well. A man must determine for himself what his standing in society or among men shall be. He may make a slave of himself, and by ceaseless drudgery render himself miserable and unhappy, and even complain of the low, menial nature of the pursuit; he has not brains enough to understand, when intelligently conducted, agriculture presents a field for the most healthful physical labor, and fulfills, more perfectly than any other, the conditions required for physical improvement and development.

By the introduction of improved methods, labor-saving machinery, and better conveniences, its most unpleasant features and burdens have been or may be removed, and the present be made pleasant, attractive, and agreeable. Farm life, with its long winter evenings, its stormy days and seasons of comparative leisure, furnishes opportunities for reading and intellectual improvement, enjoyed by but few other classes of people.

In nearly every other department of legitimate business, to say nothing of questionable pursuits, strong temptations to wrong doing constantly present themselves which too often result in the corruption and moral ruin of those who engage in them.

"He chooses well, who selects the calling farthest removed from demoralizing influences, and which is best calculated to promote, in the highest degree, the elevation and improvement of him who pursues it." Now is it not evident that agriculture, when properly conducted, is the most desirable and best adapted to the present wants of man? We remember with pride the illustrious men who have sprung from the ranks of our profession. Washington and Lincoln and Greeley and Webster, are among the great ones who "belong to the ages." And we look with a degree of complacency on seeing farmer Jeremiah Rusk holding a seat in the "Cabinet," and a Vice-President whose princely estate on the Hudson is the admiration of all true lovers of the beautiful. We might mention hosts of wealthy men who are farming for the benefit of health, or relaxation from business cares. Dr. Webb, whose magnificent estate, "Shelburne Farms," is situated on the shore of our beautiful Lake, is an example.

Let us strive to follow the example these men are setting us, let us adopt their methods and emulate their ambition, and we shall

more properly appreciate the dignity of our vocation. Let us make use of the knowledge we possess or can acquire, and grasp the meaning of the old saying, "Be thou displeased with what thou art, if thou desire to attain to what thou art not, for where thou hast pleased thyself there thou abidest."

Something of a sensation has been created by the report that the farming population of Vermont is gradually diminishing, and that thousands of abandoned farms are the result. It is surprising how widely the report has spread and how general the discussion of the question has become. Is it true that the State is fast drifting toward insolvency? It cannot be denied that there has been a tremendous drain on the young manhood of Vermont to build up and develop the resources of newer parts of the county. Vermont's brain and muscle are conducting enterprises in every section of our broad domain, and holding positions of trust in every walk in life. In many farming districts the population has fallen off in numbers. This is peculiarly applicable to some of our mountain towns, while the valleys, especially in the vicinity of villages, have perhaps held their own.

I have read somewhere, that never since the days of Ethan Allen has our Green Mountain State offered better inducements or greater opportunities for energetic, judicious farming than at present. We doubt if this statement is altogether correct, for the opening up of large areas in the West has so increased the amount of beef, mutton and farm produce that the supply may be said to exceed the demand, which has necessarily lowered prices. Yet we do not honestly and candidly believe that at the present price of real estate in Vermont, a man can get larger returns for the money invested in farm property here, than in newer parts of the country, provided he uses the same amount of energy, economy and industry that is required to bring him success there, and that, too, with a less amount of hardship for himself and family. We are dealing with Addison county; let us see whether *we* are retrograding or not. The population of the county reached its maximum, 2,6549, in 1850. It numbered 2,500 less in 1860, or to give the exact figures, 24,010. In 1870 there had been a further decrease of 500, leaving only 23,484, but it is encouraging to note that in the next decade we made an increase of 700, making us 24,180. I have no means of telling what our next census report will give us, but probably the figures will not materially change.

The town of Addison in 1830 had a population of 1306, and has almost steadily decreased in number until, in 1880, we could only count 847 souls, and there has probably been a small decrease in the past ten years. During the decade ending in 1880, those towns in the county making greatest gains were Vergennes, 406, and Bristol, 214, while those making the largest loss were Weybridge, 196, and Salisbury, 127. For this dropping off in population in what are styled rural towns, there are of course causes, and while many attribute it to the fact that farming is no longer remunerative, I trace it to very different sources. Because I am more fa-

miliar with Addison than other towns, I will state the facts as they exist here, believing that what is true of this may apply in a greater or less degree to others. The leading reason is perhaps emigration, and taking into consideration the number who have left us, and the few who come back, we congratulate ourselves that we have held our own so well. Another, and an important one, too, is that families are no longer so large as formerly. The family of my grandfather consisted of seven children; these seven have altogether raised twenty-one sons and daughters, an average of three each. These twenty-one, of whom the youngest is about thirty, and all of whom, except three, are married or dead, have had born to them twenty-two children, an average of one and ½ part of one to each. This seems rather funny, nay it sounds absurd, and is a fact to be deplored. Yet our family is not the only one in the boat. The Gulley's consisted of a family of twelve lusty boys and girls, and they can just about number their offspring on the fingers of their hands. The Clarks cannot boast of doing much better, and the Whitfords and Willmarths and Burbers and Gorhams can make little if any better showing. The supply of babies does not seem to be equal to the demand, which is contrary to the general rule in most economic questions, when supply is in the excess. Where formerly there were from five to ten strong, lusty youngsters, now there is a paltry one or two, and a single life in many cases is all that stands in the way to mark the extinction of an entire branch of a family. Again a third reason. If we cannot increase our population by generation, which seems to be out of fashion, the only alternative is by immigration.

Let us see what inducements we can offer *them:* a good, cold, but healthy climate, fairly productive farms at very low figures, and——have we told it all? Do we offer anything in the line of good roads? Anything in the way of first-class country schools? Anything to promote social life? Is the church an earnest, thriving one and well sustained? We will suppose an intelligent young man in search of a farm and a home comes along, here are a few questions some one of you will have to answer.

You have a settled physician, I suppose? where does he live?

Well, at present, we have to go to Vergennes or Middlebury for one. We had one here a short time ago, but some of us thought the coat he wore didn't look professional, or he wouldn't vote, as we thought he ought, so we did not give him our united support, and he thought best to try new fields.

Where do you do your trading? I suppose the people patronize the town store?

Well, at present, we do our business at Vergennes. We used to support two stores, and they did a fair amount of business, but we sort of got a notion of driving down to the city, and I suppose we did not patronize them as we should, and they closed out. If some one would only start another I hope we would do better.

I suppose the people take much interest in their schools, don't they?

Well, yes, we have as good ones as we can, under the circumstances; still we are not altogether harmonious in regard to them. Mr. A., B., and C., have a few children, while Mr. X., Y., and Z. have none, or their children have finished their schooling. Mr. G. has a boy that is quite well advanced, and needs a first-class teacher, but Mr. K. is Committee and his little girl is so small that he thinks a teacher can be procured for $2.50 per week that can teach everything required, so sometimes our schools are almost a failure.

Well the church looks thrifty, I've no doubt you sustain that by attending and contributing liberally for its support.

Well, I'll tell you, the church is small; only four or five men stand back of it now, and they feel quite discouraged. It's so hard to raise sufficient money to pay the minister. I don't know as we outsiders contribute as freely as we should. You see if we stand off the solicitor we have thought it so much saved to lay by for a rainy day. We used to have a large strong church here, every one attended, but now I dare say that half the men who live within sound of the church bell have not attended service for five years, unless to pay the last tribute of respect to some departed friend, and I think I'd not be misrepresenting by saying there are children within three miles that are ten or twelve years of age who never looked inside a church in their lives, and would no more know how to appear in a Sunday School, than if they were just transported from Middle Africa, or the land of the Hottentots, instead of having always lived in a civilized community. You see about fifty years ago the church was split in twain by the Millerite movement, and two churches tried to prosper where there was only room for one; since that time both have steadily decreased in numbers as well as religious interest. The bitter feeling engendered hindered growth, and the result has been an inestimable blow to the moral prosperity of the town.

The intelligent young farm hunter is discouraged, and thus soliloquizes as he drives on: What can these shrewd business men be thinking of? Can they not understand that on these institutions depend the very foundation of prosperity and civilization. Do they not realize that by withholding their support from church and school they knock out one of the props of pecuniary and moral success? They may believe that refusing a dollar, when called on to subscribe for these objects, is so much saved; but it is the falsest kind of economy, it's a penny wise but a pound foolish. They give no thought to the prosperity and happiness of their children, the coming generation; they eat, drink, save, sleep and are merry, but to-morrow will die, leaving as a heritage to their children some property, but minds uncultivated and in moral worth largely deficient. I must look elsewhere. I had hoped to settle here, but I must give my children better advantages than can be obtained here. The people are not progressing; in fifty years the town will be settled by an inferior race, or the people must awaken to what pertains to all their interests.

Gentlemen, these are the facts in the case, as I look at them. Are not some of the towns which are decreasing in population similarly situated? and will not these principles in a measure apply to them? The restoration of agricultural prosperity is a deep problem, of which many things have been said and written, and out of which many interesting and valuable discussions have grown; yet it is likely that the end is not at hand, and that the true solution remains hidden, to be discovered only by experience.

C. R. SMITH.

MUTTON SHEEP AND STOCK-RAISING.

Read by B. W. Smith, at the Addison Meeting.

The situation to-day of the farmer in Vermont, and I might say in all New England, is such that he is anxiously inquiring in the words of the Scriptural young man, "What must I do to be saved?" "Saved from the necessity of placing a mortgage upon my farm. Saved from the horrors of the insolvency court." And it is the peculiar duty of such a gathering as this to answer his question in such a way that he may not "go away sorrowful."

In the words of a more of less eminent statesman, "It is a condition and not a theory which confronts us." With our real estate depreciating in value day by day; with capital seeking investment in "wild-cat" schemes in Alabama, in Texas, or anywhere, so that it be outside Vermont; with the very best of our young manhood flocking to the West; the situation certainly deserves the consideration of all thoughtful men.

The problem presented for solution to the farmer to-day, may be stated somewhat in this wise: Given—a farm of 150 acres of land—estimated value $30 per acre; to find—a maintenance for himself and family, an education for his children, and a competence for himself in old age. And how is he to do all this? How is he to realize the money to pay his taxes, his store bill, his blacksmith's bill, and, above all, the wages of his hired help; for it has been truly said, that talk is cheap, but it takes *cash* to buy rum and pay hired help. What will our farmer do? Will he raise grain for market in competition with the Western brother, who can lay corn down at his very door for fifty cents per bushel, or even less, and other grains at correspondingly low figures? Hardly. Can he breed beef, and sell his three-year-old steers at $4.50 per hundred weight? *No*. Will he do better at dairying, with butter at fourteen cents per pound? Not any. Will he engage in breeding trotting horses, that greatest of all lotteries, hoping that he may become the owner of an Axtell, or a Sunol? He will *not* if he wishes to keep his boys from race tracks, and himself free from debt. What, then, can he do? I answer—raise sheep. Yes, I believe that, at the present time, sheep-raising is the most lucra-

tive pursuit in which a farmer can engage. "Would you breed sheep to the exclusion of all else?" I hear some one ask. No! for I am a thorough believer in "mixed" farming. Every farmer should keep a dairy certainly large enough to supply his household with milk and butter, and to enable him to buy his groceries with the proceeds of the surplus. He should also own a brood-mare, and rear horses necessary for his use. But let him depend for his main source of income upon his sheep. The Vermont sheep-breeder has the opportunity of choosing between two widely different systems. He may breed the Merino, or some one of the coarse-wooled varieties. The wool, or the mutton sheep. If he adopts the former, his flock will be necessarily small in number. I say *necessarily*, for the requisite care and attention cannot be given to a larger flock. His clip of wool will be only an incidental item; for he will look to the sale of his sheep for the greater part of his revenue. The sheep he sells will be taken to all parts of the world to improve the wool-growing qualities of flocks already existing. It is, therefore, obvious that when in any section *wool-growing* ceases to be *largely* remunerative, the Merino sheep raiser will be cut off from a market in that locality; for the Merino is pre-eminently a *fleece* sheep. The Merino sheep-breeders of Addison county have achieved for themselves *in the past* an enviable reputation. The whole world has come to buy of them, and fabulous prices have been realized. But this is a thing of the past. When the Western wool-growers began to feel the effects of the tariff reduction in 1883, the sale of Merino sheep stopped, never to recommence till wool-growing became again largely profitable. Thus the only reliable outlet for these sheep was closed. Through the indomitable courage and enterprise of two of our young townsmen, a market for these sheep is being opened up in Australia, but it seems hardly probable—owing to the great risks run in transportation and other causes—that it will prove an outlet upon which any considerable number of breeders can rely. But if our farmer does not like a system so dependent upon the fluctuations of the wool market, he may elect the other course and breed the mutton sheep.

Let me picture to you, as well as I may, my ideal of the "mutton—for revenue—with incidental wool" sheep. If a ewe, she will weigh from 100 to 125 pounds, be rather long-bodied, round ribbed, of good hight, and without a wrinkle back of the shoulder. Such a ewe will shear from six to seven pounds of washed wool (worth this year thirty-five cents), and will rear a lamb which will, with but ordinary care, weigh at weaning time sixty pounds. Such sheep will find a ready sale at any and all times; for we all must eat, and mutton is becoming, year by year, more a staple article of diet. Now as to what breed the *best* mutton sheep belongs, we find on this point, as on all others, a difference of opinion. Some prefer the long-wooled varieties, the Leicester, or the Cotswold. Others, a "middle-wool" sheep, a South Down, or a Shropshire. While still others select a grade, produced by

crossing some of the varieties already named. For the past five years the Shropshire has led in the popular estimation as an excellent mutton sheep, though many criticize its fleece as coarse, harsh, and dry. It is my opinion that the grade produced by judicious crossing is the most practical and profitable sheep to raise, particularly in flocks of considerable size. In my own experience good results have been realized from the progeny of a Cotswold ram and a Merino ewe. Some would go still farther and breed the half-blood, thus produced, to a Shropshire ram, securing by this method a distinctively *mutton* sheep, which yet retains some of the fleece characteristics of its progenitors. But whatever path the breeder marks out for himself, let him walk therein. Let him remember that the days for careless and hap-hazard breeding are over, and that he who selects his type of sheep and then breeds for it, keeping constantly in mind this ideal, will be infinitely more successful than he who is "blown about by every wind of doctrine," and is changing his methods constantly. Let him not fall into the error of thinking that *anything* in the *shape* of a sheep is profitable to raise, but let him set before him the most perfect sheep of which he can conceive, and endeavor to attain it. And above all, let him remember that sheep-breeding in Vermont requires *brains*. It may not be the same type of mind required to deliver an eloquent sermon, or make a jury-moving plea, but it is *brains*, nevertheless. Just here a word regarding the care of sheep may not be out of place. I have not the assurance to believe that I can furnish anything particularly new and instructive to such a gathering of veteran farmers as I see before me to-day, and my only excuse for presenting things which doubtless all know and acknowledge to be true, is, that we do not all practice them. All those who have ever kept sheep in flocks to exceed one hundred in number, will, I think, agree with me when I say that for flocks of that size, the thorough-bred of any of the coarse-wooled varieties is not the most profitable. They require a greater pasturage in proportion to their size than other sheep; they reach maturity at an early age, the ewes being seldom fit for breeding purposes after five years, and in general do not thrive when kept in large flocks. To secure the best results, sheep should never be allowed to run in flocks of more than seventy-five or one hundred, but sometimes the farmer is so situated that he is *compelled* to form a larger herd. In winter the same rule holds good. The smaller the flock, the better the result. Particularly is this true in feeding grain, where, if the flock is large, the poorer and weaker ones are crowded one side by the stronger animals. The skilful feeder will divide his sheep into two or more flocks, grading them according to their size and condition. More skill and judgment are required in the *successful* fattening of sheep than most people imagine. The successful feeder does *not* sit by the coal-fire and allow his hired man to tend his sheep. He tends them himself. He observes carefully whether all eat; whether a large portion of the flock leave the trough

before the grain is eaten, thus indicating that the ration was too large, and in many ways gives that close attention to details, so essential.

Every sheep-shed should be supplied with pure water, spring water if possible, though we are not all fortunate enough to possess that. Sheep will *exist* if compelled to eat snow (provided they can get it), but the trouble and cost of carrying water to them will be amply repaid by the added thrift of the animals. A lump of rock salt placed so as to be easily accessible, is also a part of the furniture of the perfect sheep fold. The sheep will thus be enabled to supply the wants of nature without danger of securing too much. A little powdered sulphur scattered upon the salt occasionally will produce a good effect in cleansing the blood of the animals, and also in destroying that pest of all mutton sheep—ticks. Ticks are an obstacle to all breeders, particularly to the inexperienced feeder. He will be puzzled to know why his sheep do not gain more rapidly. It is astonishing how much grain a "ticky" flock of sheep will consume, without any perceptible improvement. A certain remedy is to dip the lambs in strong tobacco juice about two weeks after the *sheep* are shorn. A second dipping is sometimes necessary to destroy the progeny of the knits. By this method I have known large flocks of *coarse sheep* kept entirely free from these troublesome pests. But it is during the yearning season that sheep require the closest attention. They should then receive, beside the best of hay, a ration of grain. Beets are an excellent feed at this time, as they produce a free flow of milk. As soon as possible—say as soon as a week old—the lambs should be given access to feed themselves—a little bran and corn meal being suitable for the purpose. I have assumed that the lambs are to come before the ewes are turned to pasture, that is during the first days of April. This I consider to be much the best plan. The lambs are ready to wean, and for market, earlier, and the ewes have a longer period in which to recruit.

And now as regards the profits of sheep-raising. Let us take, by way of illustration, a flock of 100 ewes of the kind I have described—weight 100 pounds—shearing six pounds of washed, or eight pounds of unwashed wool per head. Estimated value $4.00 each. Our flock will eat twenty tons of hay. They should also be fed 100 bushels of oats, or their equivalent. Provided they rear ninety lambs, the flock will require seventy-five acres of pasturage. Now our account stands something like this: Receipts,—600 pounds of washed wool, at thirty-five cents per pound, $210. Ninety lambs at $3.50 per head at weaning time, $315. Total gross receipts $525, or $5.25 per head. Expenses: twenty tons of hay at $8.00 per ton, $160. One hundred bushels of oats at forty cents per bushel, $40. Seventy-five acres of pasturage at $1.25 per acre, $93.75. Interest on value of flock, $24. Total expenses, $317.75. Net receipts for the flock, $207.25. Net receipts per head, $2.07. Now please compare these results with those from a dairy of ten cows, usually considered the equivalent of 100 sheep.

You will observe that to equal the returns from the sheep, each cow must yield an income of $52.50 in the gross, or $20.70, net. How many dairies in town, think you, have yielded their owners the past year a gross income of $52.50 per cow? Not many, I imagine. And please notice that I have not taken into the calculation the vast difference in the amount of labor required in the two cases. Here the balance, like that of cash, is largely in favor of the sheep. But, says some enthusiastic dairyman, I feed my cows a grain ration all the year; I have a silo, and give them ensilage; I take my milk to a creamery, and by these means I realize *more* than $50 per head. In reply, I would say, that I will feed more grain to my flock of ewes and raise the yield of wool to seven pounds per head. I will have my lambs dropped in January, and by an additional outlay of grain and labor, will sell them in New York by the first of May for from ten to fifteen dollars her head, and still beat him. But let us look at this matter from another standpoint. The gross receipts from our flock were $525. Subtract $25 interest on the value of the flock, and $500 remains. If we assume that 125 acres is sufficient to maintain our flock of ewes with their offspring, the receipts per acre, will be $4. At twenty dollars per acre (which is all that Commissioner Valentine would have us believe our improved land is worth), this is not a bad return. If we deduct $1.20, the interest on the value of the land, we still have left $2.80 to pay us for our labor. I have heard it stated often of late that it is no longer profitable to grow wethers until three or four years of age. Now while I consider the raising of lambs to be the *most* profitable, yet there is still a fair balance on the right side of the sheet in growing older sheep. I have in mind a flock of seventy-five three-year-old wethers, for which the owner has several times the past season refused an offer of four cents per pound, weighed at home. These sheep, good judges have estimated would average to weigh 115 pounds. Their wool has yielded an annual income of $2 per head for the past three years. Thus, if the owner had sold these sheep the 1st of December last, his gross receipts would have been $10.60 per head. Deduct $7.60 for cost of keeping—which is a liberal estimate—and there still remains a balance of $3 in his favor, beside the advantage of marketing all the hay and grain on the farm. Let my cattle-breeding friend compare these figures with the proceeds from his three-year-old steers. His account will read something like this: Cost of raising calf first season, $5; cost of keeping the same three years, hay at $5 per ton, and pasture at $4 the season, $32. Total cost, $37. Now, if he sold his steers for $50 he has a balance in his favor of $13. Putting eight of such sheep as I have described as equal to one steer, we find their net returns to be $24, thus making $11 difference in their favor, as compared with the steer. In making these estimates I have endeavored to be conservative, and keep well within bounds, and I think you will admit that I have done so. I crave the pardon of the audience for introducing so many figures, which I know

are always uninteresting, but I found them necessary to enable me to sustain my position.

To conclude, I believe that the hills and valleys of old Vermont still afford ample recompense for well-applied effort. Here our ancestors lived and thrived, and we may thrive also by emulating their economy, energy, and frugality.

PLAIN THOUGHTS FOR EVERY-DAY FARMERS.

Read by E. R. Towle, at the Franklin Meeting.

Before proceeding with my subject I wish to refer to the past. In January, '76, there was held in this hall a meeting of the old Board of Agriculture, the only one of the kind ever held in town previous to this one. The hall was well filled and the meeting an interesting and profitable one. The chairman and the one who presented the opening address, both esteemed citizens of the town, have passed away, but they are not forgotten. Of that Board Prof. Seely was Secretary, and there were associated with him Col. Mead, Dr. Hoskins, Z. E. Jameson, C. Horace Hubbard, A. T. Smith, G. S. Fassett and C. H. Heath, a goodly representation, you will say. Yes, it was; but what of that band to-day? Three, Col. Mead, Z. E. Jameson and C. H. Heath, have ceased from their earthly labors, but their memory is with us to-day, and in the work that is now being done in the cause of agricultural progress let us not forget what has been accomplished in the past. It is also with much respect that I should speak of Mr. Lane, a later member of the Board, but always interested in its work, who was so suddenly called from earthly scenes and labors, while yet in the pride and strength of manhood.

As you all know, I am a farmer, born and brought up on a farm, and have no other expectation but that I shall continue along in this occupation while I live, with no desire of change, so far as in now apparent. I am interested with my brother farmers in their labors, their responsibilities, their desire for genuine improvements, their oft discouragements and the hope and faith in their occupation that buoy them above these and are precursors of real success. Along with you I have studied and planned and toiled in my chosen or inherited occupation, meeting various obstacles and achieving some success.

I do not know that this town is superior to many others in situation or in soil, yet I am not aware that there are any abandoned farms, as they are termed, but that all the available land is occupied or cared for in some way. I think that this is a matter for congratulation, and hope for the future of our occupation. I think it would also be difficult finding another town in which there are so many farms that are being left in the same family from generation to generation. This is pleasing to contemplate, and it has quite an important significance to

me. I notice in this fact a real love for home and all of its associations, that will not readily permit it to go into strange hands; a breadth and scope of calculation and labor that has much more than present results in view. Where we see these homes, these farms, we can realize that the present generation, while it is enjoying in a measure the benefits of the labors of its ancestors, is still at the same time planning and working for the interest of those that are to follow. Permanent and substantial, not makeshift work, is being done here. Such farms have a story of hope and contentment visible in their surroundings, so plain that "he who runs may read," and are held in high esteem by their owners. Happy be such homes, blest such communities.

We have passed through a most remarkable year, one that will be likely to be remembered for a long time to come. It has been a year of wonderful production, and as a consequence the markets have been more than filled with the various products of the soil. As a result prices have gone down low, very low for almost everything that is raised upon the farm.

Take our leading industry, the dairy, and what can be said of that? I think that those who patronized the creamery or cheese factory were fortunate, as responsibility ended with the delivery of their milk, and they got their pay for it at a fair price compared with that which ruled for butter.

Then those who made their own butter and disposed of it about as fast as made were equally fortunate, as events proved. Holding butter for a long time has received a check, I think, that will not soon be forgotten. This method has worked very well in the past, but will hardly do now. The experience of the past year, it seems to me, will necessitate some changes in the future. One will be a more general patronage of butter and cheese factories, as preferable to private manufacturing. Farmers working up their own milk will be likely to sell the products about as fast as made. What the result of this move will be, if generally followed, it is a little difficult to predict, but we hope it may prove better than the practice of holding it, at least. Now some may want to know what we farmers are going to do under such discouraging circumstances and uncertainty as regards the future. Can we turn our attention to any other branches that will permit any better success than dairying?

I confess I cannot see much promise of relief, turn which way we may. There is an old saying "that it is a poor time to swap horses when crossing a stream." About all branches of farming are in the same condition as dairying at present, if we may except the keeping of sheep, that seems to be a little more remunerative. There is no particular reason why a dairy farmer should not also keep at least a small flock of sheep. This used to be done years ago on nearly every farm and was a profitable business, either the wool or lambs, it was calculated, paying the cost of keeping. As this part of my subject will be thoroughly discussed by a member of the Board, I will pass on.

Now please let me tell you about what course I would like to, or consider best to, pursue on the farm the coming year. To begin with, it is not certain, neither is it probable, that the present season will be as productive as was the last. This being the case, we should not look for so greatly an over-stocked market, although we perhaps shall not realize very much of advance in the prices of farm products. But I would keep right along with about the usual routine of farm operations. Perhaps, I am sure, I should like to do a little better in whatever I should attempt, as that would help in satisfaction and, I should expect, in dollars and cents, at the end of the year.

Having kept cows, and made butter always, as you may say, think I will keep right along now, as it is a long road that does not have a turn somewhere, and better times may be expected ahead. But as competition will be sharp, and as a consequence prices comparatively low, I would look more to the details of the business than ever, so as to be able to make up somewhat in price of product by increasing in quantity—from the same cows—superior quality, better marketing, economy in feeding, etc.

If there are any poor cows in the dairy, would try to get rid of them some way, so as not to tax the good ones in caring for inferior animals. I would not mind so much about the size of the herd as the quality. "The more cows the more honor" will not count for much unless they happen to be pretty good ones. I would endeavor to feed and care for them a little better than usual, doing the best possible under the circumstances. What, when butter is so low, would you advise giving extra care and feed? You certainly could not expect to get your money back again, says the doubtful and hesitating farmer. Yes, I should, within reasonable limits and judiciously followed. It is going to cost so much any way to support the animal, and then if I can give a little more feed and a little better care, here is where I think the profit will come in, if anywhere. I do not believe in a farmer being niggardly with his stock; it will not pay.

Animals will respond very much in the same ratio that we exhibit in our treatment of them. I will not stop to say anything about the process of butter making, as that, with matters relating thereto, will be fully and ably treated by the members of the Board. Under present circumstances will make butter, but if situated differently would probably find it best to patronize a creamery.

I would advise making the best use of the skim-milk possible, as this will be a considerable item in the account. In my case a part will be given to select calves, as I believe a farmer should raise his own cows, and good ones, too. Pig keeping comes in well in connection with dairying. Do not say prices are so low better throw the skimmed milk away than to try and make anything out of it with pigs. I do not think so. Get a good kind of pigs and feed it to them; they will thrive upon it and along with a small amount of grain feed make excellent pork, either to sell or to keep.

The manure made from this kind of stock is an item that should not be over-looked. Some farmers do exceedingly well with swine and find a profit in this part of their business. "Gather up the fragments so that nothing be lost."

Another thing: Poultry can be kept on most farms to advantage. I do not mean that it would be advisable or best to go into the business on a large scale, but moderately it can be made to pay, both in eggs and the chickens raised. Here the sour milk will be found an important article of food and will make excellent returns. Let the women and children have a chance here, and they will usually make a good use of their opportunities.

Now as will be seen in the raising of calves, the keeping of swine and poultry come in incidentally upon the dairy farm, and help to put to a profitable use what would otherwise be a waste product. It may be that in the prosecution of these minor industries a good share of the real profit from the farm will be most apparent, rather from the more special ones alone.

The thrifty farmer, favorably situated in Northern Vermont, will not fail to make the best possible use of his sugar orchard, as the product from this, aside from what is required for family use, are often quite a source of income. And the same may be said of the fruit orchard properly managed and cared for. It is the income from all these sources that will, in the aggregate, make a pretty respectable sum at the end of the year, and prove that farming, rightly conducted, can be made to pay. I have hinted at the keeping of sheep before, and would ask farmers to consider this matter more fully, and see if it would not be for their interest to keep a few of the best mutton breeds, for which there is always a good market demand. Where this can be done without too much outlay for special fencing, I think it can be made profitable.

Now I would carry the same spirit of good calculation, enterprise and persistency into all the operations of the farm, as I have tried to show would be best in the care of the dairy and stock. Would have the general work of the farm well done and in season. To say "there is no need to hurry, time enough," is too commonplace and indicative of want of real interest and laudable ambition. A farmer should not be always in a hurry, but he should know the value of time and the importance of having his work done in season. I think we should make some marked improvement in our methods and work from year to year. Can we not follow up this plan more fully this year than ever before?

Let us endeavor, so far as circumstances will permit, to put the soil for crops in better condition, use the best of seed and the most thorough cultivation, doing our part faithfully for more abundant results at harvest time. This, the raising of abundant crops, is essential to the best success in the keeping of stock. Do not say it will be cheaper to buy grain than to raise it. If there is help on the farm that should be employed to the most profitable purposes, then I would say by all means put the land to the best possible use, make it produce to the utmost, always with a view to its grad-

ual improvement. Then if more feed is wanted and can be used to a good purpose, buy it, but this should be done judiciously and with some knowledge of what will be best to buy and feed.

If the cows are expected to give a good amount of milk and the young stock to grow thriftily, there must be plenty of feed and the more of this that can be raised on the farm the better it will be for the owner. Messrs. Smith and Vail have presented the subject of winter dairying from their standpoint of experience and observation, and have certainly made a good showing for the same. I think it would be well for farmers to consider this matter as fully and candidly as possible, and perhaps some may find it to their advantage to adopt this particular method of dairying. I do not expect, however, that farmers in this part of the State will very generally make much change from present methods as it is so much of a change they will hardly dare to undertake it.

Perhaps some will think I have laid out a pretty good season's work, and will wonder how it is all going to be accomplished. Well, it will be by properly planning the work in advance and then carrying it out as it comes in rotation, to the best possible extent. Very likely it will not leave much time to be upon the road or for matters that do not have much connection with farming, if indeed with anything that is particularly beneficial or useful. We should first aim to keep our work well in hand, and then if there is any spare time attend to other matters or go visiting.

A veteran New Hampshire farmer is quoted as saying at an Agricultural Meeting in that State: "Generally, if farmers do not succeed, it is because they do not put thought enough into their business." There is, I think, much truth in this assertion. Farming is not now what it was once, and if a man is to succeed in the business, it will be at the expense of thoughtful study, careful observation of what others are doing, and timely and well-directed labor. The farmer should be a careful reader—not of cheap novels or trashy newspapers that I am afraid are working more injury to a portion of the community that should be interested in better things, than all the really good periodicals can counteract. There are plenty of excellent papers and books suited to the farmer and his family, that will be of the greatest help and advantage to them. A father who does not furnish a sufficient amount of suitable reading for himself and a growing up family of boys and girls, is, in my opinion, missing one of the greatest opportunities of his life.

If by this means the attention of the rising generation can be diverted from the unwholesome and often debasing kinds of literature that are being scattered broadcast over the land, and turned to the acquisition of knowledge that is helpful, moral and elevating in character, what an excellent work would be accomplished. Still more, if the boys and young men by this means become interested in the occupation in which their fathers so much desire they shall become proficient and successful, then will the reward for careful instruction and painstaking efforts in their behalf be most satisfactory and complete.

I look to this meeting for good results, something that will cheer and encourage the farmer at this time in his occupation, and help him to go forward with increasing zeal and diligence to do the best possible in his work, with a reasonable expectation that there shall be a reward for his labor.

THE NEW AGRICULTURE.

Read by J. W. Newton, at the Stowe Meeting.

It is growing more and more evident that the farmer who follows the methods of twenty-five years ago, cannot, as a rule, succeed. The great industrial and political changes which are going on are many of them against the farmer. The farmers of this country must change their methods if they would prosper. A new agriculture must take the place of the old. The changes demanded by the times are two-fold: First, those which require political and business organization and co-operation; and second, those which call for improved methods of farm practice.

It has always been difficult, and has by many been thought impossible, for farmers to combine. But the pressure which is being brought to bear upon them is forcing them to organize. Other industries and lines of business are organized, and are making their power felt. Organization is the spirit of the age. Men feel that one person can do little or nothing, while thousands or millions united or skilfully guided, possess vast power. It has come about under our form of government that any organization which can control either much money or many votes, or both, can ordinarily get what it wants. The corrupt use of money in influencing legislation is one of the political evils which farmers have to meet. As things have been in the past, farmers have voted for the candidates set up by the leaders of their political parties without regard to their own interests. Now a change is taking place. Instead of blindly voting for the party candidate, the farmer is learning to vote for men who are pledged to maintain his just demands. In the East a simple plan of organization has been adopted called the Farmers' League. It was started in Massachusetts to enable the farmers of that state to cope with the old combine. A national organization has been perfected and the League is rapidly spreading in other States. A silent, powerful revolution has begun which seems destined to secure for the farmer that influence in legislation which he so much needs.

Another great evil is lack of business co-operation among farmers. When a farmer has an article to sell, he goes alone to the buyer, who makes the price, and puts it so low that he can get a good profit. The railroads make a good profit carrying it, the other middlemen who handle it make good profits, but the farmer makes little or nothing. When he goes to buy implements or goods he has to pay the seller's price, which includes the profits of manufacturers and middlemen. Now suppose twenty farmers in a town or county each want a plow, or mower, or other imple-

ment. Buying as they usually do, each by himself, they pay all the agent's and other profits. Now suppose they were so organized that one of their number could buy the twenty machines directly from the maker, a saving of many dollars would result. Whether farmers sell or buy, by organization and co-operation a great saving can be made.

It is thus evident that organization and co-operation are essential parts of the New Agriculture. There are some farmers who have conscientious objections to joining any secret, political or other society. Such men are to be respected; but when farmers draw back from organizing on account of intense conservatism or selfishness or similar reason, their course must be strongly condemned.

We now come to the bearings of the New Agriculture on methods of farming. Here we note—

1. *That the New Agriculture must be based upon science.* The farmer of to-day cannot afford to be guided by blind guesswork. He needs a knowledge of facts. The value of chemistry to the farmer is pretty well understood. The experiment stations are doing a great work. Much of it as yet is preparatory, and the stations have hardly begun to show their usefulness; but that they will do a vast amount of good is certain. Farmers base their practice often upon mere appearance. Take a familiar illustration. Many farmers sow their fodder corn, getting a large-growing variety, and upon rich ground often harvesting an immense crop. To the untrained eye it appears all right and much labor is apparently saved. But what does science say?

At the Cornell University Experiment Station, corn was put in on plots of one-tenth of an acre, in hills, drills, broadcast, and broadcast harrowed.

The following table gives the results. The values are in comparison with timothy hay at $12 per ton:

	Yield lbs. per acre.	Dry matter lbs. per acre.	Value per acre.
Hills	20,610	4,431	$30.00
Drills	24,555	5,291	35.74
Broadcast	14,535	3,196	19.72
Broadcast harrowed	17,065	3,488	21.64

This table will enable farmers to decide whether it pays to sow fodder corn, and shows how deceptive appearances are. This is further illustrated by the Cornell experiments as to the best period for cutting corn for fodder and ensilage. The pastures usually begin to fail in July, and corn fodder is cut early in August, before the ears are fully formed. In the following table the value per acre at different dates of cutting is shown:

Date of cutting.	Total yield pounds per acre.	Dry matter, pounds per acre.	Feeding value per acre.
July 24	18,762	2,000	$14.05
Aug. 8	24,578	4,039	26.16
Sept. 3	27,674	7,214	47.33

These figures are almost startling. That a farmer suffers a loss of over thirty dollars for every acre of corn he cuts just before it gets to the roasting stage, seems too strong a statement to be true; but it is abundantly confirmed by experiments at other stations. We all know that apples and other fruits are not fit to eat unripe, even when nearly or quite fully grown, though cattle eat them voraciously. Corn should begin to glaze before being cut for the silo or fodder. Hence an early variety should be planted. The interval between the failure of the feed in the pastures and the maturity of the corn can be provided for by ensilage which has been kept over, or by clover, clover rowen, green oats or other soiling plants.

2. *The New Agriculture must be adapted to existing conditions.* Too many farmers do as their grandfathers did. It will not do to follow the practices of twenty-five years ago. Changes are taking place in all industries, and in none more than agriculture. Woe to the man who clings to the old ways of farming. Take for example the breeding of cattle. A few years ago almost any kind of cattle could be sold for a price that was fairly profitable. To-day the best butter breeds are the only cattle in which there is any profit to most Vermont farmers. The man who follows the old ways of breeding cannot make farming pay. So with butter making. New methods of feeding, caring for the cows, and handling the milk must be adopted or dairying will not pay. A great majority of the farmers who are growing poorer, and who are disappointed and discouraged, would find the cause of their trouble in the fact that they are going on in the old ways, and not conforming their methods to the present times.

Take the subject of manuring the land. The old way was to use barn yard and stable manure for all crops. Then came fertilizers, which were often bought and used indiscriminately. The latest methods may be summed up thus: 1, Cattle are kept in stables when not in pasture, and all manure, liquid and solid, carefully saved; 2, rich cattle foods are used; 3, chemicals are applied to plots until the needs of the soil are learned; 4, clover is used either with or without chemicals.

The use of home-mixed fertilizers is steadily increasing. First find what the soil needs. Many so-called poor soils need only one or two elements of plant food to produce good crops. A field may have abundance of phosphoric acid, but lack potash. In such a case money spent for phosphoric acid may not exactly be lost, but it would bring no immediate return. If there is potash enough in the soil, adding more may injure the crop. Nitrogen is necessary for wheat, but applied to corn is generally either unnecessary or lessens the crop. A farmer cannot be up to the times who does not learn what his fields need and fertilize them accordingly, provided he uses fertilizers. The best way is to mark off plots of one-tenth of an acre, leave some without manure or fertilizer, and put potash, phosphoric acid and nitrogen separately, and combined,

on the remaining plots. So much has been written on this matter that I need not enter more into details.

One of the most valuable plants we have both for feed and fertilizer is red clover. Alsike clover is valuable for hay, it makes a heavy growth on moist soils, and its second crop will probably be a good substitute for early cut fodder corn, but its roots spread near the surface, instead of going down deep as do those of red clover. In the sub-soil, below the reach of the roots of ordinary plants, is a large amount of fertilizing material; red clover brings this to the surface and makes it available for future crops. Another use of clover is to supply the soil with nitrogen, which is the most costly ingredient of fertilizers, costing from 10 to 18 or more cents per pound. It is also removed from the soil by drainage, and the question of its supply is a most important one. The air is composed of four-fifths nitrogen by weight, hence over every acre of land there are about 38,000 tons of nitrogen. Late experiments seem to prove that clover and other plants of the same family, beans, peas, etc., "are able to acquire large quantities of nitrogen from the air during their period of growth." An acre of red clover, roots and stubble, has been found to contain 180 pounds of nitrogen, besides large quantities of other kinds of plant food, amounting in value to about thirty-five dollars, as the value of fertilizers is estimated. A ton of clover hay contains about nine dollars worth of plant food, and its feeding value is about fourteen dollars. The total value of an acre of clover producing three tons of hay, the roots and stubble being plowed under, would be about one hundred dollars.

MORE CLOVER SHOULD BE GROWN IN VERMONT.

It is one of our most valuable plants, and is destined to occupy a prominent place in the farming of the future. If one finds difficulty in growing it, he should try ashes, or muriate of potash. Clover makes good ensilage. Clover hay is valuable to feed with corn fodder or corn ensilage, to make a better ration than farmers often feed. By growing red clover the fertility of farms is kept up when heavy crops of wheat and potatoes are sold. A three years rotation is used, clover, potatoes and winter. wheat. The manure of course is carefully saved and returned to the soil and no fertilizers are bought; and the men who follow this practice make farming pay. A longer rotation might be necessary here; but, if clover can keep up the fertility of farms from which wheat and potatoes are sold, we, certainly, who sell little except butter, ought by the use of clover to keep up the fertility of our farms. To cure clover for hay, take a day when you are pretty sure of a spell of good weather, cut late in the afternoon, rake up the next afternoon, if pleasant leave in the windrow and get in the middle of the next day. If one does not care for the clover to feed, it can be cut and allowed to decay on the ground.

3. *The New Agriculture demands intelligence and enterprise.* It takes little enterprise to make 100 pounds of butter per

cow and get fifteen cents per pound for it, but it takes intelligence and skill and thought and study to make 300 pounds per cow and sell it for thirty cents per pound. It is easy, in a certain, sense to follow the old ruts, but when the man who does this sits down at the end of the year to figure up his profits, he is likely to find them very small, if not wanting altogether. There is no industry where thought and intelligence pay better than on the farm, and there are few men whose occupation requires daily labor who have such opportunities to use their mind as farmers. Not one farmer in ten thousand realizes the advantages he possesses over the men who work in shops, mills, and factories. "Manchester workmen complaining of the monotony of their work, said: 'It is the same thing day by day, sir; it's the same little thing; one little, little thing, over and over and over.' Think of making pin-heads, ten hours a day, every working day in the week for a year—twenty, forty, fifty years! A nailer in the midst of clatter enough to drown thought, does his day's work by pressing into the jaws of an ever-ravenous machine a small bar of iron, which he turns rapidly from side to side. Think of making that one movement for a lifetime! Such dreary monotony is the most wearisome of all manual labor. It admits of little interest and no enthusiasm in one's work; and worst of of all, it cramps the mind and belittles the man. Once the man who made the nail could make the iron fence, also; now he cannot even make the nail, but only feed a machine that makes it. Beyond question, under the minute division of labor, the operative tends to degenerate. . . . The incessant repetition of the same hard work dwarfs the man, robs him of his strength, wit and versatility." Our County, pp. 95,96.

How different is the condition of the farmer! Instead of being shut up to a mind-dwarfing round of monotonous toil, he finds ample scope for thought, study, and growth. Modern progress, instead of forcing him down and back as it has the workman, has rather forced him to use his mind. The present depression in agriculture is causing thousands of farmers to use their brains, is leading them to study and think and improve their methods, as perhaps nothing else would have done.

But how can the farmer who lives back on the hills where he has few opportunities of seeing and being influenced by the progress in agriculture? Few farmers are out of convenient reach of the post office, and if a man can get his mail once a week or so, he need not go without means of help and encouragement and information. There are the Experiment Station bulletins and reports, many of which are of great value. Then there are the real, genuine agricultural papers, not the miserable catch-penny affairs, with their poor paper and print and trashy advertisements, but the carefully edited, well printed papers, with their hosts of intelligent contributors, with instruction gleaned from every field. No farmer can afford to do without some of them. They will bring him information, encouragement and cheer, and do him and his family much good.

The farmer needs every help he can get. He needs courage and enthusiasm. If he is cast down and desponding, hopeless and disheartened, he will hardly achieve success. Faith in God is a priceless blessing; it gives a wondrous power over worry and corroding care. It is a blessing to get in the way of looking on the bright side of things, and to learn to be thankful for the blessings God is giving.

THE ORIGIN OF DEVON CATTLE.

Read by M. F. Preston, of Sharon, at the Royalton Meeting.

The Devon belongs to the middle-horned variety and are descendants of the aboriginal breed of Great Britain. From the earliest records the Devon can be traced as the peculiar breed of the country from which they take their name, where from time immemorial they have reigned alone, clad in beautiful red, curly coats, well suited to the cold, damp climate of their hill country. They were imported into the United States from England at the beginning of the present century and are increasing in numbers without any effort being made by breeders to introduce them.

The first pure bred Devons that we have any record of in this country are one bull, named Taurus, 197, and six heifers, presented by Mr. Coke, afterwards the Earl of Leicester, of Holkham, England, to Mr. Robert Patterson, of Baltimore, Md. Of their arrival in this country the following notice in the volume of the old American Farmer, page twenty-nine, reads as follows:

"June 10, 1817. The Brig Margaretta, Captain Gardner, arrived at Baltimore from London, England, with six beautiful young cows and one bull, of the Devonshire breed, for Mr. Patterson and Mr. Caton, the whole being a present from Mr. Coke."

American Farmer, volume 3, page 112: "The bull is one year old, and the six heifers of two years old each."

Nearly every herd in the United States has descendants from the six heifers. These six heifers were named follows: Europa, 128, Fancy, 134, Flora, 143, Longhorn, 206, Nancy, 244, Strawberry, 349. Fancy in 1810, produced Fancy, 1179, by imported Taurus, 197, this heifer in the fall of 1819 was sold to S. & L. Hurlburt, Winchester, Conn., and from her descended his family of Fancys and Beauties. Longhorn in March 1819, produced Holkham, 688, sold in the fall of 1819 to S. & L. Hurlburt, Winchester, Conn., and used by them till 1834, when they sold him into New York State, and he died there in 1839, at the age of twenty years. Holkham, 686, and Fancy, 1179, are claimed to be the first Devons calved in this country, and probably are the first that are recorded. Strawberry, 349, produced in 1819 heifer calf, Strawberry, 2567, by imported Taurus, 197, sold fall of 1820 to S. & L. Hurlburt, and from her his family of Strawberrys descended.

Why I speak of these three cows more particularly than the others is to show to you how New England is indebted to the Earl of Leicester. Nearly every herd in New England has descendants from these three heifers.

Lemuel Hurlburt, of the firm of S. & L. Hurlburt, so familiarly known to every Devon breeder, was born at Winchester, Conn., 1796. Lemuel Hurlburt was the Devon man, his brother Samuel having no taste for cattle breeding, but as the brothers were partners in general business so were they joint owners of the Devon herd.

I quote from the Homestead, an Agricultural paper of that day: "Mr. Hurlburt died in 1856; in the decease of Lemuel Hurlburt Agriculture has sustained a great and irreparable loss. For the last forty years he devoted his time and attention almost exclusively to the improvement of *various kinds* of stock and to the cultivation of the soil. His lands exhibit an increase of fertility rarely equaled in this country. In nothing, however, did his efforts meet with a better reward than in the importation and improvement of the North Devon breed of cattle. He was the first to introduce that celebrated breed into New England and to his acute and far-seeing judgment the soil of America is largely indebted for the most beautiful cattle that ever stood upon it."

From this celebrated herd Vermont has received her share. The late Sylvester Hall, of East Burke, Vermont, imported direct from the Hurlburts. His son, the late Harly M. Hall, was a careful and successful breeder of Devons; he was known to everybody in Caledonia county. The Devons of the North part of Vermont can be traced direct to the three heifers that the Hurlburts purchased.

Within the last fifty years there have been large importations into the United States from England. Some of the very best blooded animals that could be procured have been among these importations, descendents of Forrester, Hundred Guinea etc. Some of those that are the most noteworthy are Comet, 34, Bloomfield, Duke of Flitton, Albert 6th, and many others I might mention. This breed is spoken of as the little Devon. However Barrister, 281, weighed 630 pounds at 8 months, at four years old 2,275 pounds, Felix 2d, 555, 1,530 pounds at 2 years, Duke of Hamden, 504, 2,030 pounds at three years old. Cows when in milk weigh from 1,000 to 1,300 pounds.

I have given you a short historical sketch of the Devon cattle; now I will speak upon the merits of the breed. 1st Hardiness; 2d. Bloodlikeness or ability to preserve peculiarities through indefinite periods of time; 3d. Aptitude to fatten and quality of beef; 4th. As druaght cattle; 5th. Docility. 6th. Value of milk product.

HARDINESS.

Their muscularity and constitutional vigor are naturally fixed; the Devons originating centuries ago. The wild grasses were thinly scattered on the hills and steep surfaces in North Devonshire; it afforded them only scant feed and occasioned them much

exercise in searching for their subsistence; by such exercise the full muscles of the breed have been developed and compacted. The hilly pastures of New England tend to *strengthen* and *maintain* their *inherited* fullness of muscular growth; therefore I claim that they stand at the head of all cattle in perfectness of form and muscularity.

The Devon is known in every climate from the semi-tropics to the frigid region, and from our own rigorous New England to the mild climate of the Pacific slope, which goes to show that they are successfully handled in all the varieties of climates on this continent.

I am one of the youngest breeders of the Devon, having bred them only about ten years; why I made choice of the Devon was on account of their hardiness and I have not been disappointed; my pastures are hilly and rough and they have to grub for their living during the summer season; when I go into my pastures I never expect to find any of them sick; I never have been troubled with abortion among my Devon cows; of the Devon herds that I am familiar with I never have as yet heard of a case. My idea is that an animal's strength, activity and hardiness depends upon its muscular structure.

BLOODLIKENESS OR ABILITY TO PRESERVE PECULIARITIES THROUGH INDEFINITE PERIODS OF TIME.

It is a strong point of the Devon to transmit its peculiarities from one generation to another; it is a fact beyond dispute that the Devon owes its superiority in this regard to its great development of muscle; that it is a factor of great importance to a breeder of cattle is also so generally admitted that I need say nothing more upon this point.

APTITUDE TO FATTEN.

A breeder of long experience with different breeds of cattle, says that they (the Devon) would thrive where others would starve, yet they will repay good care and feeding as well as the best, and persons that have bred different breeds of cattle claim the aptitude of this breed of cattle to fatten as being unequaled. I claim this is one of the strong points in favor of the Devon. The Devon calf is always a full calf on its milk alone, rolling in fat, and with all the build of an old animal; I have had them from six to eight weeks old weigh, on an average, 200 pounds apiece, on the milk of their dam; I had one at five months old I raised by hand, that weighed 430 pounds. The Devon will take on flesh rapidly, giving better results in proportion to feed and care, and pay the producer a larger profit than other breeds; the beef of the Devon is considered second in quality to the little Highland ox. It is known in the city of London as the nine penny beef, all other as the five penny; it is of great value to the consumer, because the meat is more perfectly mottled, the fat and the lean being so mingled as to make it the beau-ideal of beef. They dress a larger

proportion of clean meat to the weight of the living animal than other breeds. This is my own experience of those I have butchered.

AS DRAUGHT CATTLE.

I will have but little to say on this point; they are a general favorite where draught cattle are used, and are idolized by their owners; they make the handsomest oxen as to form; beautiful in color; in strength they cannot be beaten; quick in their motion, which is requisite of a good ox.

DOCILITY.

This is a trait admitted by all who have had opportunity to study the merits of the breed. Its value is prerequisite of a good cow or an ox, and scarcely less desirable in cattle for any purpose. My cattle, from the young calves up to mature cows and oxen, are quiet and peaceable. I have no unruly ones. My bull, Mars, at eight years of age, is gentle as a calf; never has been cross; I never have known one to be vicious, unless made so by mismanagement. As a breed they are intelligent, and they show it by kind treatment.

VALUE OF MILK PRODUCT.

As milkers, when the quality of the milk is considered, I claim they are second to none. Dr. J. Cheston Morris, of Philadelphia, says: "For several years I have been in the habit of placing at the Agricultural shows, side by side in a box with ice, jars filled with milk obtained from the cows of the different breeds on exhibition, such as Jerseys, Guernseys, Ayrshires, Durhams, and Devons. The cream line stood nearly equal in the Jersey and Guernsey with the Devon, but was much less in the Ayrshire and Durham. The skim-milk of the Devon was the richest of all in sugar, as the taste readily showed."

I bought of Mr. Putnam, of Cornish, N. H., a heifer calf that was six months old, which weighed 375 pounds after being drawn from Cornish to Sharon in a wagon. Mr. Putnam informed me that it did not have a drop of new milk after it was three days old. His herd of cows were all Devons. I raise all of my calves on skim-milk, with middlings added. I will mention one calf in particular. Marswell, 4197, dropped the first of December, 1886, dam, Favorite, 5535; at one week old I put him on to skim-milk; when he was ten months old he weighed 600 pounds. I speak of this to show you that the skim-milk of the Devon is of a superior quality for feeding purposes.

BUTTER QUALIITIES.

I will now speak of their butter qualities. There are numerous cases on record where cows have produced from twelve pounds to twenty pounds per week. When I commenced to keep Devons I wrote to Ward Parker, of New Hampshire, asking him if he had

any cows to sell and if so what their butter qualties were; Mr. Parker writes: "As to butter, my cows, five in number, average something over 200 pounds per year for each cow besides furnishing all the milk and cream for my family of four persons; I have not found any other breed of cows that will make as much butter for the same keeping as the Devons." The late E. C. Bliss, of New York, bred for butter only and had a marked success. His full grown cows yielded him an average of 300 pounds per annum. He writes that his cow, Helena 32d, has a record of 19 pounds in seven days on grass alone. After an experience with Durhams, Herefords and Jerseys, Mr. Bliss gave his verdict in favor of the Devons; his herd is now in the posession of his grandsons, the Rumsey Brothers & Co., Westfield, N. Y.

Mr. J. A Pomeroy, of Sidney Center, N. Y. writes: "We make as much butter from our cows as the best of them do; we average 230 pounds to the cow per annum of a dairy of twenty-four cows."

Mr. King, of Watertown, Ct., writes as follows: "The cow Beauty is one of the three I have tested for butter; in twenty-one weeks she produced 196¾ pounds on grass without grain. Compared with Jersey butter, quality and color, etc., by the owner of a Jersey herd, he pronounced it to be superior in flavor and as rich in color."

When I commenced with the Devon I started for a general purpose animal; I thought I should find it in this breed. I wrote to Mr. Fish, of Washington, that I would like a bull calf out of his old cow, Silya, and if she had one to save it for me; he wrote back that she had met with an accident, that the cow and calf were both dead, but that Juno had one, one week old I could have for $25. I procured the calf and I am now the owner of some of the best butter stock in the United States. This was before Juno became noted as a butter cow. Mr. Fish entered her in the contest for a butter premium open to all Devon cows in the United States, she won the second premium of $40, having made 16¾ pounds in seven days. It is a fact of note that the bull calf, Mars, 2,197, I bought of Mr. Fish, descended from Hurlburt's Beauty, 506; this cow produced 16 pounds per week during the month of June, 1850, at the age of sixteen years when most of cows are in the land where milk pails are unknown. I see by the Herd Book she dropped at the age of twenty years the bull calf, Litchfield. How much longer she lived I have no knowledge.

In summing up the whole matter, I am more and more confirmed in my opinion that for the farmer of the State of Vermont, and especially on rough and hilly lands, no cattle are so well adapted as the Devons.

GENERAL INFORMATION.

Read by R. C. Goodale, at the Addison Meeting.

The text selected for me this morning, is certainly a very liberal one, embracing much more of interest than can be condensed into the few remarks that I shall be able to offer you. It ought to confer some credit to address the people of the first town of the first county, of the State, (alphabetically,) of the first State of our Union for spruce gum, maple sugar and handsome women, upon the broad subject of *General Information*. That an address of this character will be scanned by the critic's eye is evident, because of the unlimited ability of the self-appointed critic to strain at a gnat and swallow a camel.

That the subject, should be so treated as to bring forth fruits from the great field of Agriculture is to be expected from the nature of an Institution. When we walk forth to contemplate and examine this great field, we soon find ourselves surrounded by a vast expanse, reaching far beyond the horizon of our knowledge. At every step we discover new truths and undeveloped facts. As we advance over this great plain we receive new lessons from the bountiful hand of Nature. We gather new ideas, receive new experiences, and entertain new hopes; as we proceed we learn of the sunshine and the storm. We find that Mother Nature teaches unerring lessons. I claim that if man will follow the teachings of this unerring guide, with good judgment, it will lead him on to success; with bad judgment, he will be a successful failure. I admit man is governed many times by circumstances beyond his control. It would be poor judgment to rely upon exhausted nature for a bountiful crop, you would receive your lesson all the same. While we stand in the midst of this great expanse, meditating upon its undeveloped resources, surrounded by its beauties, drinking in its pleasures, partaking of its benefits, our mental vision leaps beyond the horizon of our surroundings and goes sweeping back into the misty past, among the prehistoric tribes and clans. In those dark ages (so-called), mankind had no knowledge of Agriculture, and had no necessity for it. With his spear, bow and arrow, he could go forth before breakfast and master a competency for the day. He could draw from the well-filled storehouse of nature wherewith to meet all of his necessities, and he was happy (not such a dark age after all), no poverty, all wants supplied by Mother Nature. He could eat, drink, and be merry, when he was a mind to, and live. How is it to day?

This world three-fourths water, one-fourth land, much of it rough and poor, with fifteen thousand millions of people to maintain, and Nature's storehouse well exhausted. The condition of affairs is changed, very materially. "Times ain't as they used to was," and Agriculture has become a stern necessity, and with all of our boasted knowledge and science, poverty and want go stalking through the land, casting dark shadows over the future. Yet

Mankind still obeys the command, Eat, drink and be merry, for to-morrow ye die. Quite a dark age yet, when one has to continually delve and toil to keep the wolf from the door.

Look over this vast field of Agriculture again, and you will see it divided and sub-divided into many branches called science; here is horticulture, bee-culture, stockraising, etc., which for our purpose can all be called farming. Then farming is the soul of science, the foundation and corner-stone of the whole structure of our civilization. It is the grand principle and great fountain-head, from which all other streams of life must flow. Farming is the greatest and noblest profession of them all. The hand that guides the plow maintains the world. And, friends, that hand should rule the world, and can, if it will. Farming, as a science, as a profession, as a teacher, as a means of mastering a competency for life, stands far ahead, outweighs and shines brighter, and reaches farther than all of the high-sounding professions of the day. Friends, any one of the latter sinks into utter insignificance in comparison. I can point to bright and intelligent farmers in our own town, county and State, who possess and know more common-sense law than many of the knaves of the legal profession. I can show you some farmers wives who know more of the healing art than any quack that kills with his little pills. I can refer you with pride to farmers who have a brighter idea and a keener sense of justice than many of our ignoble judges. I can select farmers from among us, who have higher thoughts and better conceptions of theology, than many of our bigoted preachers. There is more true, natural music gushing forth from the farmer's soul, than can be drawn out of the tunebeats of the musical profession. There are farmers who possess truer ideas of gain and profit than are practiced by the tricks of the trade in our mercantile fraternities.

The true farmer is full of ideas and resources, and can turn his hand to anything. He travels along the broad highway of his calling, and is not confined to a one narrow-idea rut, worn deep by following a hobby. The farmer can climb the enchanting hill of his science, and on his upward way he can linger among its unfading beauties, drink deep of its crystal fountains. He can press forward and become learned and honored, can join in the march of fame, while the balmy winds waft gently around him. He can stand on his high eminence, calm and serene, and view the surrounding world with solid comfort and pleasure, and know and feel that he is one of the lords of creation, and such is the make-up of independent nations.

The farmer's life is the life for me,
  I own I love it dearly;
To plow and sow, to reap and mow,
  Or in the barn to thrash, sir.
Tis all the same to me, I plainly see
  'Twill bring me health and cash, sir.

Unlike other professions, farming is a science which is not dogmatic. Its followers must remember the fact that science, in the

modern sense, does not indulge dogmatic statements and final conclusions, but that as its animating idea is the discovery of truth; it changes its hypothesis as fresh evidence shows the incompleteness or untrustworthiness of former decisions, hence the broad and liberal ideas and expanding education of our profession. Experience is the great instructor, and brings out the hidden truths of farming.

That there are mistakes made in farming through experiments, there is no doubt, I made one myself this season; my oats cost me $1.20 per bushel. I should have been all right, had it not been for the prayers of Judge Story and Uncle Hoyte, of West Addison, during a drought years ago. The Judge demanded the rain to be sent down in copious showers, while Uncle Hoyte requested it to fall in long drizzling rains. If those venerable gentlemen had lived until the past season each would have been perfectly satisfied that their prayers were fully answered, for the rain did come as both requested, and we had to take the consequences of those petitions. Hence my mistake; I sowed my oats before I caught on to the racket. I remember while exchanging ideas with one of our best farmers, upon dead furrows, neither of us favored them. I remarked that I thought best to have a few to carry off the surplus water in the spring. His reply was, if everything is all right, then it is all right; if it is all wrong, then it is wrong. So much rain proved to be all wrong, dead furrows or not, and certainly dead furrows are very unpleasant things in a field.

Too much land is sometimes a mistake. While conversing with another of our best farmers on the question of land, a few years ago, he replied that when he was a young man he wanted all of the land, and if he'd had the money he would have bought it all. He was satisfied that one could have too much. Such mistakes prove to be a beacon light of safety and success to those who will learn of them. Those who feel that they want more land, just learn how to grow two blades of grass where one grew before, and you have doubled the size of your deeds, and dodged taxation, and large expenses. There can be no fixed rules established to govern the agriculturist under all of his varied conditions and circumstances, it will not do to follow the same line of practice under every case. Vermont ways and methods of farming could hardly be practiced in Colorado, New Mexico, or California. It would hardly do to practice irrigation in the Champlain Valley, especially during the last season. Hence the farmer must well understand the conditions of his surroundings and adopt such rules of practice as shall best suit his requirements. He should be well versed in the great questions of the day; he should understand political economy, especially when all the sharks are after him. He should know that he needs protection instead of destruction, and then exercise his elective franchise to his best interest.

He is a very important factor in the make-up of our United States, and should be prominent among our Representatives in

Congress, and know what becomes of the people's money. It costs more money to oil up and keep the machinery of Congress in running order than is paid out to our National defenders. I notice that two hundred general pension bills were presented in one week. What a grist to grind when less would do. Allow me to make this statement, that a liberal pension policy based upon service record to every man that can present his honorable discharge, would surround this nation with a stronger safeguard than a standing army or the new navy, and coast defences, and not cost near so much.

Grant our soldiers a liberal pension, and in time of war we could recruit our army out of the ranks of the enemy. There would be a grand rush from other nations to fight our battles for us, because of the liberal policy of our nation in compensating its soldiers for service rendered. I want that nail driven home and clinched in the mind of every one.

Again, the farmer is important in Congress to look after the public domains. Our government is very liberal with its lands, giving millions of acres to railroads and syndicates, etc., and then charging the humble citizen double price for it. Who is this government, anyway? The people who own the land. The people—then let the people have the lands for settlement in suitable tracts to pay for settling. "Oh!" says a beardless stripling of the legal profession, "farmers cannot draft laws and frame them in shape and get them through Congress." Well, I will admit that nobody but knaves and fools could possibly get up some of our laws; they speak for themselves. Farmers should be united. Too many try to play a lone hand, and do not succeed. Union is strength, and the farmer's interest should be combined for protection, because John Bull and all of the bears of the stock exchanges are after them. I have been in some of those places in our large cities, and down in the pit was a greater *pow-wow* than I ever experienced on the plains among the Indians away back in 1860.

Farmers of Addison county, and of Vermont, do you not know that it is high time that you were more united, that you should combine your interests and stand up for your rights. Why stand aloof from the general order of the day, and try to combat single handed against all of the combinations of the day? Is it not a day of pools, trust syndicates and unions, and can you find one of them all that cares a cent for your interest? No, not one. Then is it not high time for you to combine your interests and stand for your natural rights? May you not surround yourselves with safeguards and promote the general welfare of the farming interest, by uniting yourselves and exerting your forces in one direction, and secure greater benefits in the purchase and sale of your commodities? Would it not be for your best interest to join together and establish at some central point, like Addison, or even Vergennes, a farmers' trading post, under the management of a competent board of officers, a president, secretary and treasurer, with directors, an agent to receive his salary from

a fund accumulated by members' admission fees deposited in bank, subject to the order of the directors? I respectfully invite a discussion of the question, feeling confident that such a scheme will meet with the approval of many. Let me add this caution: the greatest danger to a ring of this character is the establishing a ring within the ring, for when the little ring becomes larger than the big ring the big ring is liable to burst.

I wish to call your attention to a subject of universal interest, and especial interest to the farmer: That is our roads. Are our highways in the condition that shall afford the general public the benefits that their rights and interests demand? Are they constructed so as to confer upon the farmer their full benefits? Would it not be for the best good of all to combine the road funds and build a rock road sixteen feet wide and one foot deep along some general highway? I would call for a discussion of the road question, believing it to be a subject much neglected.

Allow me to make a comparison between this beautiful Champlain valley and the rest of our country. I have traversed its length and breadth. I have seen it from many points of vantage. I have learned much of its people; seen something of its developments, and know some of its characteristics; become acquainted with its advantages and disadvantages; also some of its possibilities; wth its transportation facilities of to-day, and what may be. It certainly is not very remote from two important commercial centers of the world, Boston and New York. I am confident that all will agree with me that the further you get away from these centers, the more you must pay for goods, and the less you can obtain for your products. Again we are not very far from the commercial center of Canada; when in the near future commercial relations are adjusted, Montreal may not be any disadvantage to our valley. Our State, taken as a whole, has less waste land in proportion to its area, than any of the twenty-four States of our Union that I have traveled over. Our mountains are all clothed with nice timber; our hillsides are occupied with the useful and ornamental; our spruce and maples are no small factors of our State, while the Rocky Mountains are quite bare, and are rightly named. The hills and mountains of Colorado, New Mexico, Arizona, and much of California, Nevada, and Utah, are quite sparsely timbered.

Our minerals are quite extensive. We can mark the world with marble. We can furnish roofing slate for the world. Our Queen City, Burlington, as a lumber market, stood only second in the United States, next to Chicago, that great New York of the West.

Stand with me upon the tower of Grand View Mountain, and view the landscape over. Look to the east, and let your vision follow along the beautiful Otter Creek valley; then along the winding fair, beautiful farms, and woodlands, villages, and country residences. Then feast your eyes on the grandeur and beauties of our famous Green Mountains. The southern view reveals new beauties, with the famous Lake George nestling among the hills of

New York. The western and northern scene enwraps the beholder in wonder and amazement. Our lovely Lake Champlain, coursing its way northward along the foot hills of the noted Adirondacks, bearing upon its heaving billows the mighty steamers, and the white sails of its commerce, with the mountain ranges on the right and left, forming a beautiful background to this splendid and grand panorama, making the most magnificent and charming view I ever saw in all my travels. This valley is historic ground. Here have been enacted many noted events of history and daring deeds of our ancestors. Look again, and you see thirty-four church spires pointing heavenward. This valley is Vermont's garden of the gods, and in comparison with Colorado's noted garden it far outstrips it in beauty and grandeur. When in the Apacha valley, I remarked to Dean Childs that there was but little difference between Colorado and Vermont, and that difference was in favor of Vermont.

I would not swap the Champlain valley for any place I ever was in, except the Pacific slope, which certainly surpasses us in climate and much that follows. That slope is certainly a wonderful country. To see the green fields, and waving grain, flowers and trees in blossom in January and February, is very enchanting. To sit in the shade of orange trees, with coat and hat off, eating of that delicious fruit in January, seems remarkable. To have our long winters changed to May and June, and feel the balmy breezes waft around you, would be very agreeable.

I have climbed the noted Mount Hamilton, and could see over the beautiful Santa Clara valley, with the splendid city of San Jose, surrounded by many orchards and vineyards. I could see away across the great San Jacquene valley, and behold the eternal snow-capped range of the Sierra Nevada mountains. It was charming and enchanting, indeed. But it lacked our lovely Lake Champlain. I have steamed along the coast and obtained many beautiful views of that grand Pacific slope. I have wandered up the mountains and viewed, through the field-glass of our martyred John Brown, the San Gabriel valley, with its railroads, orchards, and cities, with mammoth hotels and costly residences, like Passadena, and that new extended outlet onto the grand old Pacific Ocean. It was splendid, and made me feel that I had no more use for old Vermont. But there was no Lake Champlain. I have wandered across the desert, and passed over the plains along the great Salt Lake, and viewed its placid and calm waters, and through its splendid valley, which is surely one of the gardens of the world. Been through the Black canyon, and along the Royal gorge, thence on down through the Grand canyon of the Arkansas. Amid all of this grandeur and sublimity, Mr. President, no grand scene of them all can form such lasting impressions upon one's memory—can give such inspirations to the soul—can chain one in such wrapped admiration as the sublime grandeur of our beautiful Vermont, Champlain valley.

Friends, I ask you one vital question. Do your farms pay,

under the present system? Your farm does not pay if it affords you only a livelihood. The labor and superintendence of the owner is in value to the support of the family. Labor, brains, and capital working together, furnish the best combination for success, and, centered in one individual, should be able to secure it beyond a doubt. Your accumulations should be equal to the legal interest upon your capital invested. If your farm book-keeping shows this, then the question is answered in the affirmative. If it does not pay, then you must adopt better methods, or you will in time be a successful failure, as the result of bad judgment. One great help to successful farming, is a correct system of book-keeping of all accounts. The balance-sheet is a good guide to the results.

STOCK BREEDING.

By George Aitken, Manager of Hon. Frederick Billings' farm, Read at the Woodstock Meeting.

The breeding of domestic animals has been made a study by men of all ages. Beginning with the oldest literature, we have, in the writing of Moses, the brief but sublime account of the creation of the world, with its plants and cattle; then we read of Abraham who was very rich in cattle, and of Isaac, his son, who became very great and had possession of flocks and herds. And then we come to Jacob, the most famous cattle breeder of the ancient world, who made his father-in-law rich, and then enriched himself out of his wages of spotted cattle. We are also told how he got his inspiration from a dream, showing him how to change the color of his flocks and herds. This record of breeding, brief as it is, has much that is suggestive to the modern cattle breeder. Jacob had a plan, adhered to it, and was successful in changing the color of his cattle, in improving their constitutional vigor, and in overcoming the habit of abortion among his herds. The object of the breeder is to produce at will, not by luck or chance, perfect specimens of the race, that shall combine all the qualities desired. Most of the modern breeds of cattle have been developed by a slow hap-hazard process, although some of the English breeds have been formed by men of genius after a well-considered plan. The results of the methods practiced for the last century show conclusively that breeds or races of domestic animals, to be successful and profitable, must combine a few peculiar excellences which are to be developed to their fullest extent, regardless of all other qualities that are incompatible with the object sought.

Let us look at the improvement made in the English race horse, a race that has been bred for upward of eight centuries for speed and endurance, and have been brought to such perfection that some of them have been able to run a mile in one minute and thirty-nine seconds, and with endurance enough to run four miles in a fraction

over seven minutes, which seems to be about the limit, as there has been little or no improvement in the last twenty years. The method by which this tremendous speed and endurance have been developed has had a direct tendency to inbreeding; the rule seems to have been twice in and once out. By a careful examination of the pedigrees of the most remarkable horses, it will be seen that in all cases there is some inbreeding, and in the greater part of the most successful, a very considerable infusion of it. And this is true not only in the race horse, but with all improved breeds of domestic animals. Take, for instance, the four fastest trotters yet recorded; Maud S., 2.08¾, Jay Eye See, 2.10, Sunol, 2.10½, and Guy, 2.10¾, and we may also add the great Axtell, 2.12, and in looking over their pedigrees, we find that every one of them is more or less inbred. Harold, the sire of Maud S., is strongly inbred to old Abdallah, No. 1, who in turn is inbred to Imported Messenger, that grand old horse who had so much fire and vim that it required two men to handle him on arriving at New York, after a voyage which usually took all the vitality out of both men and animals nearly a hundred years ago, and who appears six times in the pedigree of that wonderful youngster, Sunol. Jay Eye See is another instance of inbreeding, but the most remarkable instance is seen in the pedigree of that king of trotters, Axtell, who has a double infusion of the blood of Mambrino Patchen, runs three times to Mambrino Chief, and seven times to Imported Messenger, which accounts for his being able to finish in good form and make the round trip in 2.12. But however much inbreeding may have improved our running and trotting horses, when we come to examine the method by which our dairy cattle have been improved, we find that inbreeding has been practiced to a far greater extent. Take the Jersey cattle, for instance, the breed that is of most interest to us here in Vermont, and we will find that they are the most intensely inbred of all our dairy breeds.

The best model of a Jersey cow we have ever seen, Jersey Belle, of Scituate, was produced by breeding Victor to his own daughter, and Victor was the result of mating full brother and sister. The Island of Jersey, being isolated from the rest of the world, and its cattle protected from foreign contamination, has always been a good field for the practice of inbreeding, but such breeding has been mostly hap-hazard, and it was not until about the year 1826 that the first attempt was made to breed pure Jerseys off the Island. At that time Phillip Dauncy, of England, started his famous herd, and bred for forty years by coupling half brother and sister. His first bull, Pope, was purchased in 1826, and no other blood introduced into the herd until thirty years later, when he bought another bull from the Island, named Fowler, and from the combined blood of those two bulls descended the two famous bulls, Rioter, 2d, and Stoke Pogis, the best bulls ever imported to this country, and from whom have descended our very best family of butter cows. The St. Helier family of Jerseys is another noted instance of inbreeding the Jersey cow. Mr. O. S. Hubble, of

Connecticut, who originated this famous family, had a formula of his own, which was to breed sire to daughter, also to granddaughter, and then combine brother and sister, or the grandson of his sire. St. Helier is bred to his half sister by St Helier, and their male progeny is bred to a daughter, or granddaughter of St. Helier, with most successful results in the production of a choice type of butter cows, that are also remarkable for their uniformity of style and quality. I could go on indefinitely citing instances of inbreeding that have produced famous animals, but enough has been given to show that inbreeding may be practiced to a greater extent than is generally considered safe. But in pursuing this system of breeding great care must be taken in the selection of the animals, for the reason that bad qualities are quite as easily transmitted as good ones, if not more so. It is known by experience that the good or bad points of the progenitors of the sire and dam are quite as likely to appear again in the offspring as those of the immediate parents in whom they are dormant. Hence, in breeding, the rule is that like begets like or the likeness of some ancestor. Acquired qualities or defects can also be transmitted, whether they belong to the sire or dam, and the purer or less mixed the breed, the more likely they are to be transmitted unaltered to the offspring, so that in grading up our dairy cattle, which is the only way possible for the Vermont farmer to improve his herd, great care should be taken in the selection of a bull, to see that he is not only descended from a long line of butter cows, but that he should possess that peculiar power of transmitting his good qualities to his descendants. This is a faculty which implies a special accumulation of vital force in the generative system in common with all the other departments of the organism. This element of prepotency may consist in the ability to transmit inferior qualities as well as those we wish to reproduce, so we must see to it that he has no taint of imperfection in his make-up.

The breeders of the trotting horse have a great advantage over the breeders of dairy cattle, in that they can test their stallions on the track and, although it is by no means the rule that the horse showing the most speed will get the speediest colts, still if such horses are bred to the right class of mares there can be no doubt but their descendants will excel those of horses lacking the speed, stamina and nervous energy to send them to the front in a well contested race. This power is inherent in all the great sires of every improved breed of animals. It has shown itself in a marked degree in a few Jersey bulls as well as some of our great trotting sires, notably Messenger and Hambletonian. But it is well to notice that none of those sires were prepotent enough to produce first-class animals every time, and it was only when mated with congenial families that any of them were able to do their best. It is well to remember that of the 300 sons of Hambletonian kept for stallions not one in ten was of any particular value, simply because no pains were taken to find out whether their dams would nick well with the blood of their sire. But breeders are learning

from the mistakes of the past to pay more attention to the mating of their breeding animals.

There is yet a wide field for improvement, especially in dairy cattle. The average production per cow for the State of Vermont is only 133 pounds of butter per year, while there are plenty of herds making 300 and 400 pounds per cow and individual cows which have made from 700 to 856 pounds in a year; showing conclusively that there are yet a vast number of cows kept at a loss to their owners, and in my opinion that is one of the main causes of so much grumbling about hard times. Let us, therefore, take an example from those who have succeeded in this line. When one man can raise the standard of his herd from 100 to 500 pounds, there is no reason why every dairy farmer in Vermont cannot do the same. There is no danger of overstocking the market with first-class goods. Articles produced by the best dairies that are now considered luxuries must soon become staple articles of food, and the home demand for dairy products will increase with the population. The stability of the dairy industry and the breeding of choice dairy stock is fixed upon the basis of the progressive civilization of the age. Wherever this industry is cherished it is attended by all the outward evidences of prosperity, improved dwellings, better schools, better farm buildings, labor-saving farm machinery and the very best strains of cattle are sure to take the place of all inferior breeds. The past has shown us that Vermont can raise superior sheep and horses, and there is no reason why we cannot, with intelligent breeding and careful selections, produce a race of cattle that will divide with the American trotting horse the honor of being the very best of their kind.

HOW TO MAKE POULTRY-KEEPING PROFITABLE.

Read by Dr. G. M. Twitchell, of Fairfield, Me., in the Farmers' Course at the Agricultural College at Burlington.

(Reprinted by permission from the Report of the Mass. Board of Agriculture.)

The day has arrived when, in measuring any industry, the standard of dollars and cents must determine value. If this be thought too much of a utilitarian view, the answer must be that every surrounding influence, every possible condition entering in, forces to this one standard by which results may be accurately measured.

The trees in our orchards, beautiful, symmetrical and attractive, are valuable as orchards in proportion as they throw out on bough and twig the blossoms of May and the rich fruit of September. The dairy cow on which we are coming to depend so completely, is of service to just the extent that she produces the golden, waxy product in excess of cost of keeping. The sheep must be measured, not by fancy tastes or desires, but by the wool and mutton product.

The horses, multiplying so rapidly all over New England, are to be increased or diminished just in the ratio of their conformity to this one standard of merit. By their fruits all these must be measured. The hogs, working upon the manure piles, are being perfected with the one thought of making pork at a profit, even though the price received be low. The farmer's income must come from the production of the farm, and there is to-day no escape from a study of the worth and cost of production.

How can poultry-keeping be made profitable? By the application of the same laws as govern elsewhere,—by *knowing* that the cost of production is below the price received.

Symmetrical trees, fine-limbed and beautiful Jerseys, large and well-proportioned sheep, pedigree in hogs, beauty and blood in horses, and perfection of markings in poultry, all these must give way to *business*, in agriculture. No man places a higher estimate on these points than I; but there is a higher test, a great, controlling question of profit or loss; and to the individual farmer, struggling in the current, battling against the sharp competition of to-day, this is the question calling for solution. It is this one supreme test which will bring out the true metal and gladden our ears with its merry ring.

I want to-day to weigh and measure what I have to say, in the scales and measures of the farmer, dependent on his lands, flocks and herds for his support. The fancier can pursue any path he chooses, but with the great majority the question of bread and butter is uppermost. Therefore, while as a breeder, recognizing all that can be claimed for blood, color or markings, I would bring another standard, and measure the poultry industry in the light of possible profits for the breeder looking entirely to the open market for the sale of his poultry and eggs.

For present excellence we are indebted to the specialists who have probed to the very centre the problem of life and its wonderful powers of transmission. No stronger proof of the good work they have accomplished can anywhere be found, than may be seen in the poultry yards. I present this thought first, because it is absolutely necessary that we realize the steps leading to present standards, else we shall surely fail of maintaining our position.

The magnificent specimen seen to-day, weighing eight to ten pounds, or producing twelve to thirteen dozen eggs yearly, is not an accident. She has been evolved out of the brain and hand of man, through centuries of breeding. Place before the mind's eye a selected representative of any breed, and then try and imagine what was the type when only the wild bird existed, and through what stages of development the flocks have been rising since man was given dominion over the beasts of the fields and fowls of the air. Left to their native state, the product would be only what was necessary to perpetuate the species, as seen in the quail and partridge; but *man*—restless, unsatisfied, aspiring man—began the work of subjugation. There came to him, in the caves and fields, dim visions of what might be; and he began building upon

this foundation, and through the ages has labored patiently and persistently, until we have entered into all the fruits of the past. Why, the horse, cow, sheep or hen of to-day is a monstrosity, when viewed in the light of even fifty years ago.

No man breeding for possible profit can realize the most unless he seeks continually to come into a knowledge of the growth of the centuries. Present standards are not fixed. The law of reversion is underneath; and, unless we put ourselves into the work, and by steady application seek to advance, there is sure to come a falling away from the full measure of what otherwise might be ours. Hence the claim is made that here is the corner-stone upon which we must build, and *every* breeder must come into a knowledge of the principles involved. The great law of compensation permeates everything, and in the poultry yard we receive in proportion as we give. The large per cent. of profit possible to the breeder is contingent upon a knowledge and observance of certain conditions, the first being this one of heredity. Success is not an accident; and to you engaged in poultry breeding, I want to present this one underlying thought as of supreme importance. Know the steps leading to present standards, and patiently labor to improve. Observing these in all their details, it is possible for any breeder to realize, from every hen kept, a net profit yearly of two dollars per head, at prices realized in the market during the current year. To substantiate this, let us consider first the egg question.

I venture this, that not one in one hundred can give any adequate idea of the cost of keeping. The necessity for the itemized account is not appreciated. It must be resorted to in order for success to follow. Pencil and paper are the first requisites for the practical poultry keeper.

Towering far above the question of breeds is that of care and feeding. Our breeds are what we make them. They adapt themselves to their environments, and partake, in a marked degree, of the traits and characteristics of their owners. You have in Massachusetts a host of breeders who have stamped their own individuality upon their breeds. Any man acquainted with Light Brahmas could select a Felch, Williams or Comey bird, if seen in California before it had adapted itself to its new surroundings. So long as the controlling influence of these breeders was upon them they told the story. To-day may be seen specimens of Drake Plymouth Rocks, though he who fixed the type has long been at rest. So I might run through the list and name scores of breeders; but this will suffice as an illustration of my thought.

Judged by the standards of the market for poultry and eggs, discarding the so-called fancy issue, these men have realized great things from their poultry yards. I do not doubt Mr. Felch has secured two hundred eggs yearly from individual Light Brahmas; for no man can dream of the possibilities of this industry until he buries himself in the work, and with cautious steps looks carefully after all details. The average of production is with the breeder,

though the hens produce the eggs. That is, the development of eggs is dependent entirely upon the food question. What is an egg? It is an ounce and a half of concentrated food, made up of lime, soda, sulphur, iron, phosphorus, magnesia, oil and albumen. The hen is the mill to grind, the crop the hopper, and the egg the grist. Feed the hopper, and the grist will be forthcoming. I am aware that this is a very business-like view; but I am measuring the hen as a machine, aiming to make clear the claim for profit in poultry breeding. The great want everywhere is an appreciation of the laws of feeding, and the digestibility and assimilation of food. Every particle of the egg—yolk, albumen and shell—must come from the assimilated food through the blood cells. It is a wonderful machine of which we are speaking, capable of taking the grains, grasses, vegetables and fruits; grinding in the marvelously constructed machine, the gizzard; then dissolving, separating and distributing to the several parts the energies necessary to sustain the body, and storing material for making the product desired—eggs. We cannot feed concentrated egg-food, for no man can produce it; but we can feed the elements in the very best manner possible, prepared in the alchemy of God's providence, by a Divine Chemist; and, when fed in accordance with an intelligent plan, force the production of what is wanted.

Under the breeding of the past twenty years the organs of reproduction have been stimulated to a fury; and now it is necessary that we pause and measure the steps, in order that there be no loss in the future. If we feed corn, or other fat and heat forming food, there cannot follow the largest production of eggs, because the material for eggs is not in the corn. The tendency will be to turn the current in the direction of fat accumulation. Corn contains eighty-six per cent. of heat and fat elements. The value of any article of food is not the cost per hundred pounds, but in its power to produce what is wanted. The cheapest article of food for egg-making is that which will produce an egg at the least expense. There must be a turning from the habits of former years, and a study of this question with sole reference to cost of production.

The expense of keeping a hen varies from one and one-half mills daily to five mills. At present prices of grain, it is both possible and practical to keep our flocks in perfect health, and so in the highest state of productiveness, at a daily cost of two mills per head. We shall be the better prepared to do this as we study the food question, and in variety and quantity meet the needs of the system, supplying the food elements from the most inexpensive sources, and balancing these for egg production. It cannot be the quantity taken, but that which is completely digested and assimilated. If there be any excess, the energies which would go to the making of eggs are consumed in the vain attempt to take care of and expel all surplus. Thus food consumes food. To a certain limit we may force the storage of albuminous food; but if that limit be passed, there results a weakened condition of liver

and kidneys, which rapidly develops into disease. There must be a perfect egg ration, one that will keep the animal in health, and produce the desired product. How, then, shall we feed? Good second-crop clover contains lime for shell material, and albumenoids for flesh and muscle forming in excess of corn, and is equal to wheat as a nitrogenous food. Here, then, is a valuable food, not expensive. Oats, wheat, bran, chopped hay and vegetables, with meat scraps, must form the bulk of food for eggs, with corn as our sheet-anchor for fuel to supply animal heat or produce fat. In my own experience, I found a mixed ration most profitable. I mixed together twenty-five per cent. of oats, wheat and bran, ten each of corn and linseed, grinding all together, and then adding five per cent. of meat scraps. Cooking vegetables, or steaming chopped hay daily, and adding just enough of this mixed grain to give consistency to the mass,—say three quarts to the bucketful,—and allowing the whole to cook all night in a covered tank, I have secured a ration satisfactory, yet not expensive. To-day I would rely more largely upon clover. For whole grain I have always been governed by circumstances, finding the best results when I reduced the corn ration, save in extremely cold weather, when it must be our chief dependence, because of its heat-giving elements.

There is no way of determining the exact quantity to be fed a hen, because of the infinite variety of temperaments and habits, created and intensified by years of breeding, warmth of buildings, and want of regularity in attention. It costs as much to keep an active Leghorn as a sluggish Plymouth Rock. Size cannot be a fixed guide to quantity. Rations, as published, can only approximate. If the whole thing were settled, we could perfect a machine to do the entire work, and save ourselves much worry and labor. The fact is, these enormous profits come only in return for something given.

The normal crop of a hen will hold but a small quantity. Distend it by inviting the bird to eat appetizing food, and four times the amount necessary for health will be taken. We have all seen this, when feeding corn at night; how each bird will crane its neck, trying to force down the kernels, and satisfy the palate. The idea that an animal will eat only what it needs, is one of the beliefs we should disabuse ourselves of as quickly as possible. Every breeder must be a law to himself, seeking always to measure the needs of individuals, and to supply the smallest quantity consistent with best health and productiveness. Here is the economy of feeding, the value of balanced rations. It is not niggardliness, but true liberality; for it seeks first of all, perfect health, by balancing the condition of the animal. Nature's method is a grain at a time, and a constant searching and scratching for these. Our system too often is to crowd the food into the crop in the shortest possible time. If the nerve energies resulting from the tissue foods be consumed in removing, grinding, digesting and assimilating food, they cannot produce eggs. Each body is capable of expending so

so much force daily. If the ration be balanced all is harmony, and the natural functions are carried on smoothly. By the observance of these principles the flocks have slowly yet surely been graded-up to present high standards. To-day no man can dream of the possibilities of the future, provided the highest skill is exercised in the selection and balancing of rations.

Aiming at a solution of the problem of profitable poultry culture, the selection of breeds must receive attention. No man can succeed in an undertaking unless he has a natural inclination for it. Especially is this true in poultry breeding. Not only must he be an enthusiast, but the variety must be what his fancy dictates. One man, with a love for the majestic Brahmas, will realize many times as much as his neighbor, who attempts their culture because somebody else succeeds. Or another, full of admiration for the active Leghorn, will score a grand success, after utterly failing with other varieties. Success hinges largely on natural adaptation to the work. For want of this, there is no upward striving, no reaching forward to a higher standard. While the term Brahma or Leghorn has a certain meaning, it by no means follows that the individual of either breed excels in all characteristics. Remembering what has already been said in relation to the origin of breeds, we must get back of the bird, and learn the controlling spirit of the breeder, before we can measure accurately. A Brahma may be such in all purity, and still be almost a cypher in all points of excellence; and a Leghorn may have all the outward mark of the variety, and be wanting entirely in the power to produce the luscious fruit of the hen-house. If these premises are correct, it follows that the fancy, the ideal of excellence in the individual breeder, has more to do with success than the breed, and that any variety may be transformed to meet the requirements of the breeder. Here is the explanation why one family of Brahmas excels as egg producers, while another towers far above as poultry.

It was this spirit of unrest, this desire to realize more than had been secured, this belief in the possibility of reaching something better, combining in a still more marked degree the essentials of all breeds, that first led to the crosses resulting in the Plymouth Rocks, a breed that to-day, throughout the country, ranks second to none. The same spirit has since developed the Wyandottes, like the Plymouth Rocks in general characteristics, save color. These two varieties are proof positive of the fact that our poultry is in our hands to be molded, changed, corrected, enlarged, and built upon according to our desires.

By the application of the same principle, weeding out the inferior ones, breeding only from the best, and feeding for a specific purpose, I believe it possible in the near future to reach an average of thirteen dozen eggs yearly, with small flocks. The fact that individuals do this, or more, justifies the claim that others will, when bred, fed and cared for in the same manner. This can never come through indiscriminate breeding from any flock, no

matter how high the average. There is always a choice, and eggs for hatching should come from the hen, or those hens who excel in form and size, or as layers. To-day there is wanted a broad body, deep and compact, not long in the legs or neck, with legs well apart, in color bright yellow. Such a bird would give the greatest weight with least waste. For such, a higher price will be paid by the purchaser.

In some sections there is a demand for colored eggs; but I fancy the breeder of Spanish classes will realize as much for the white one if they are as carefully selected, and free from stains. The difference in quality of eggs is not in color of shell, but in the food supply from which they are constructed. Flavors come from the food in eggs, as well as milk.

In selecting breeding stock, be assured the hens are not an accident, but have been bred for generations from stock possessing positive virtues. Let the breeding be to fix the predisposition of heredity. Increased size, early maturity, desired form and greatest production will in this way be secured, an upward tendency being all the while maintained.

I have not urged pure-bred stock, because I am here to enforce, if I may, the one lesson of possible profits for the farmer, and not to speak for the specialists; but it must not be construed that mixed grades of any and all breeds are to be brought together, for this can never satisfy. Each breed represents a peculiar idea; each has its own individual characteristics, and excels in some particular.

For the average farmer or mechanic, wanting eggs and poultry, and without time to study the problem of breeding, and cultivate and improve on the work of the specialist, high grades will give better results than pure bloods. It is easier to improve with grade hens of one variety, and a pure-bred male, than to hold an even keel with pure-blood stock. Never use a grade male. There can be no uniformity, no satisfaction. Secure, yearly, a male pure in breeding, rich in inheritance, strong and healthy; and, making use of the best hens, there will surely come a steady advance in the type and productiveness of the flocks. Avoid all violent outcrosses. Use a male of one variety, and so reach after and secure the highest possible profit. It is business in the poultry yard we are discussing to-day,—business for the farmer with his many cares, for the tradesmen or mechanic having only limited time; and for these reasons I urge high grades. There is money in the business of breeding pure bloods, but more time and attention are necessary, a more critical study of the tastes and requirements of other breeders is demanded; and, because of this, the great majority of farmers who keep hens solely for profit, cannot do more than give a fair amount of attention to the all-important questions upon which the industry rests, and must leave the field of fancy stock to the fanciers.

It is idle for any one to think of adding poultry breeding to the round of daily duties, without subtracting the equivalent from

other cares. Farm work is exacting. Nothing can be neglected, neither can the farmer divide his attention among too many departments without loss. Better by far confine to one or two lines, and in these seek to excel. No man can succeed in poultry culture, who feeds and waters once a day, cleans out the pens when it rains, collects the eggs after dark, and breeds with no special reference to quality. These are the men who fail in everything. They are the ones who in public, and through the press, declare that the business is a humbug; that every egg costs a dime, and a pound of poultry is worth a dollar to the grower. This to them is the truth, simply and only because they reach out after and attempt to grasp every branch known to agriculture, and neglect the conditions underlying success. A daily round of little duties makes up the sum total of the labors of the poultry man; and not one of these can be neglected without loss.

The average price received by the breeders in central Maine this year for eggs will be a fraction less than twenty cents a dozen. Those of you who have put yourself into the business, and made a market for choice stock, have realized thirty cents or more. Why is it that all the farmers do not secure this higher price? The demand is active, the supply limited. It must be because they fail to observe the conditions. With the fact staring us in the face, that the market is ready to pay thirty cents a dozen for selected eggs, absolutely fresh, from stock fed on sound, healthy grain, the great majority, through neglect, fail to secure or ship their product in quantity or quality sufficient to secure more than the average market price. If we but meet market requirements, we might from the sale of eggs realize the full measure of profit claimed at the commencement of this paper. An average production of ten dozen—not large—would insure a gross income of three dollars per head. With cost of production reduced by a study of rations, the expense of keeping would not exceed seventy-three cents per head, leaving a net income of two dollars and twenty-seven cents.

But there is another field claiming our attention—that of growing poultry. To-day an exacting market meets the producer. The great West is pouring in a torrent of meat product, grown at less cost than we can possibly hope to secure. The only hope for New England is in the production of a better article, and the placing of the same on the market in choice condition. One advantage is ours—distance cannot be annihilated. We have from thirty to forty hours advantage, and to improve all this conveys, is our opportunity. Quality, then, must determine price. To secure this, we must begin at the same foundation as when looking for eggs—the parent stock. While we may possess an all-purpose hen, or variety capable of producing a goodly number of eggs, and yet valuable as poultry, it is a fact that this combination detracts from the highest excellence in either direction. A variety bred solely for eggs, will, if the work be carried forward systematically for a series of years, not only excel in this respect, but take

on a form peculiarly adapted to egg production. The wonderful elasticity of Nature's laws is surprising; and, whenever men attempt an improvement, unseen forces seem to co-operate to secure a type best fitted for the object desired. If the egg-forming habit be cultivated and stimulated, the tendency will soon become fixed in the breed; and for this reason, if for no other, that variety cannot excel as meat-producers.

Again, the breeder who seeks for the very best poultry will breed from those birds possessing the greatest merit in this one direction; form, color of leg and flesh, and rapidity of growth being the essentials sought after. Doing this, egg production becomes secondary, and the tendency is towards fixedness in flesh forming. In combining the two, there must be a dropping from the highest standard in either. While some breeders possess ability to produce both in a marked degree, as seen in the Plymouth Rocks, Wyandottes and some some families of Brahmas, it is useless to expect to equal the standard of him who bends all his energies in one direction.

Success, then, in growing poultry for the market depends upon the selection of birds bred for market purposes, and mated to produce their superiors. The great cry is for early maturity. Broilers at ten to twelve weeks, roasters at fourteen to sixteen,—here is the line of profit, and to crowd the most growth into the shortest possible time is the secret of successful poultry growing. The highest price goes to him who in twelve weeks brings forward the plumpest body, best proportioned, and with the largest per cent. of flesh, most attractive in color. Breeding only from those excelling in these qualities, and feeding for this one end, the story is soon told to the satisfaction of the breeder. The food for making bone, muscle, and flesh in the chick, is very much the same as that for producing eggs in the adult fowl. Begin at the first to feed strengthening food, tissue food, leaving the fats to be supplied later. Milk here enters in as one of the most valuable products; and by milk I mean that which has had the fats removed for churning, for this is far better than the whole product. Testing the eggs after being under the hens, or in the incubators, seven to ten days, and removing those not fertilized, we have the very best food for little chicks. Not only is valuable time saved by removing the infertile eggs, but by cooking these thoroughly, and mixing with bread or cracker crumbs soaked in milk, an excellent food is provided at slight expense. The crop of a chicken is a little thing, and should not receive more than half a teaspoonful at a time. A slight excess will destroy life or retard growth, and for the most rapid work there can be no faltering for an instant. After the third day, green food should be given. If the flocks have access to fresh grass, this will be unnecessary; but it does not do to wait for the buds of spring before starting the broods. They should begin to appear in January, and be on the market before spring fairly opens. Sow rape or oats in boxes, and cut when two or three inches high, chopping fine, and feeding daily.

For animal food, I have found meal worms extremely valuable, yet inexpensive. These I have grown in flannel or lint, kept in a warm place, sprinkled with meal, and wet with sweetened water. Later it has been my custom to use the wastes from the butcher shops, exposing until tainted, then sprinkling with meal and covering with moist, warm earth. Continue the skimmed milk as long as possible. In no place can this valuable product be made to pay better returns than in the poultry yard. In cooked food, never feed anything sloppy. A dry, crumbly mass is best. In using milk for mature stock, we must remember that it is food, and its value must be taken from the other supply, else troubles will appear. For growing chicks, the best ration I have found has been composed of thirty per cent. each of oats and wheat, twenty of corn, ten of linseed and ten of meat scraps. This, mixed into a dough with skimmed milk, I would bake until thoroughly cooked, set away at least twenty-four hours, and then pound or grind, adding more milk if I desired to feed as dough, or giving dry. In this combination I consider linseed one of the most valuable parts, but would never feed more than ten per cent. It is rich, albuminous food, and hence valuable in forcing growth. If these chicks were to furnish my future layers, then surely the ration must be changed to meet the different conditions.

Having the ration fixed as regards variety and quantity,—this last being a very important item,—there enters at once another factor that must be considered—regularity in feeding. No matter how choice the stock, how careful the breeding, how well-balanced the ration, unless regularity be observed in feeding, it is utterly useless to expect to succeed. Hunger must be appeased at once, or the system draws upon its stores for nutriment. If regular hours are observed, Nature adapts the animal to the condition; but the practice must be maintained. A little at a time, and that often, will insure the most rapid growth. Feeding in this way, forcing growth by selected rations, large size will be secured at an early period. Early maturity in everything must be our motto. The chicken put on the market at twelve weeks, to weigh two pounds, will have cost for food not more than eight cents a pound. As broilers sell readily for thirty cents a pound, or more until the first of June, it pays to grow them. Rather it pays to give a return of extra care and labor, for this growth comes as compensation for what we give.

In growing to maturity, and marketing when four to five and one-half months old, the dressed weight should be at least five pounds, at a cost for food materials of thirty to thirty-five cents, or seven cents a pound. These figures are on the assumption that a certain amount of liberty is given the chicks daily. In growing these maturer birds, the fattening process should be reserved for the last twelve or fourteen days. It is bone, muscle, flesh, that is needed,—bones strong in substance, large in size; muscles capable of carrying the frame to full maturity, and flesh of healthy structure. There is no room for puny constitutions. When the time

approaches for marketing, confine in dry pens, with only light enough to enable the bird to find its food. Here, as all the while, regularity is to be observed; but the ration now wanted is to be rich in the fats, starches and sugars; and we turn to the corn, buckwheat, barley, an increase of linseed, sunflower seeds, and enough cooked vegetables to aid digestion. Now we enter upon the cramming process, when fats are to form rapidly, and the bird pushed on to the market just before the breaking down of the tissues. As much as possible of the entire ration should be cooked, in order that the work of digestion be aided as far as we may. Feed whole corn at night, removing all that is not eaten. In the time specified, from twenty to thirty per cent. will be added to the net weight, at comparatively little cost. Such poultry satisfies the epicure. It is rich, juicy, and tender, more so than would be possible if allowed its liberty, and its muscles and flesh strengthened by exercise. When ready to ship, give no food for twelve hours, that the crop and intestines may be empty, or at least that all food may have, in the process of digestion, passed the period of fermentation.

When ready to dress, suspend the bird by a cord about the legs, and, holding the lower mandible firmly with the left hand, pass the sharp blade into the roof of the mouth, where by a quick cross movement you sever the arteries, and the vertebræ at the base of the brain. A convulsive spasm tells the story, and, before this ceases, the quill feathers should be pulled. If the work be done promptly and rapidly, the whole surface will be cleared in a very brief time; whereas, by a little neglect, the labor will be many times increased. Open and draw, making as small an incision as possible; remove the head, roll back the skin on the neck, and draw out the crop; then draw the skin over the neck, and tie neatly. When thoroughly cooled, pack in clean boxes, and never put in a bird that is marred in the least, or off color in skin. The appearance of the package when opened will have much to do with the price, and the presence of a single inferior specimen will fix the price for the whole. Dressing and shipping a superior article, the market will always be open to receive it, at prices satisfactory to the grower.

Either line of operations calls for the exercise of the highest skill, patience and ingenuity. Again I say, which you adopt will depend upon your individual fancy. In combining, two distinct ideals of perfection must be kept in view, and the object aimed at never for a moment forgotten.

When growing chicks, intending the pullets for layers, separate at an early age, and give the pullets a freer range and coarser food. Grow strong, hardy constitutions. Be sure to avoid producing fat. Bring them to laying, in simply good growing condition. A pullet that is fat will not commence laying at so early an age, neither will the process of egg forming be continued as regularly as though the ovarian system were not crowded upon by the fats of the body. We are aiming at two hundred eggs yearly as the

average of our flocks. If it ever comes, it will be by growing our pullets for layers, giving them hardy constitutions, keeping them in condition for egg producing, and providing rations adapted to the work desired. Whether it be true or not that the germ of every egg is formed before the first goes to the egg basket, this much is true,—that, if we dress a pullet just as she comes to laying, we shall find an egg developed, and others in varying size, until we have counted perhaps three hundred and fifty yolks. Back of these is what seems a mass of membrane; but bring hither the microscope, and it tells a new story. This is simply an aggregation of minute versicles, infinitesimal yolks. Count these, and we have about three hundred more. For our present purpose, it makes no difference whether these are all there are to be formed, or not. The point is here: these germs are to be developed by and out of the food supply taken into the system, digested and assimilated, treated in that wonderful machine, the stomach, freed by acids and dissolved by alkalies, and finally carried in solution to the ovary, where eggs are to be matured. The secret of the industry, if there be one, lies in the ability to force the development of these germs, by feeding rations balanced for egg production.

Only by the appreciation of this principle can we maintain the production of to-day. Instead of being five years or more, these germs must be matured and on the market in two and a half or three. Why, gentlemen, we shall not rest until we have a machine capable of yielding an egg every twenty-four hours, and then some live Yankee will go to work and attempt to double the product.

One more claim must be made for this systematic feeding. In no other way can we secure eggs for hatching that will develop and send out healthy chicks. There must be hardy constitutions in sire and dam, in order for hardy offspring. There must be virile energy in both, in order for living chicks to be secured. As the albumen of the egg contains practically all the elements out of which the chicken's body is made, and the yolk only serves to strengthen the last few hours before, and first few after, leaving the shell, it follows that this albumen must be rich in bone, muscle and flesh elements.

Again are we driven back to consider what was the condition of the parent stock when that egg was being formed. Was the hen closely confined, and fed largely on corn, or was she given abundant exercise and nitrogenous food? The whole question hinges right here, and here is where the great majority fail. They bring their pullets to winter quarters after a season's run with the cockerels, the food having been such as would put the latter in marketable condition. It is no wonder eggs are not forthcoming, though the comb reddens, and the musical sound is heard. Confine these birds in warm, sunny pens, feed liberally on food easily digested, and then expect eggs that will hatch. Why the whole line of operations has been to defeat this very end. A moment's reflection will convince that it is utterly impossible to expect returns under such treatment. Here may be found an explanation

why one failing with Plymouth Rocks succeeds with Leghorns, because of the natural habits of activity in the latter. Not that he succeeds in securing the most financially, but in keeping his flock alive through the winter,—something impossible with larger breeds, when liberally fed and kept from exercise.

Thus far the attempt has been made to present the question of breeding for profit, and to show, if possible, on what basis the industry rests, and how the claims made may be substantiated. There remains another question to be answered. Will the poultry industry pay the average farmer, and what is the cost of commencing operations? After an experience of more than twenty years I can answer the first part of the query decidedly in the affirmative, measuring the business by market standards. It has paid me just in proportion as I have observed the conditions urged in this paper. Year after year I have realized a net profit of two dollars per head; yet to-day I can look back and see how I failed to appreciate the significance of the lessons I have presented for your consideration and discussion. There is more in store than we have yet attained to. In all operations, one must learn to walk before he runs the race, and small beginnings lead to great results. This is a business having to do entirely with cents and fractions of cents.

A building to accommodate fifty hens can be built for from twenty to thirty dollars. Expensive structures are not necessary. Such a building would be 20 by 12, with seven-foot posts; sills, 4 by 4; studding, 2 by 3; boarded and shingled, the walls covered with tarred paper or battened, and paper used inside; two windows on the south, twelve lights, each 8 by 10; door at the end; with roosts two feet from floor, across opposite end; and flooring six inches below, to catch droppings. Add nests and drinking dishes, and the house is ready for the hens. In building such a hen-house, select a dry, gravelly knoll, haul on small stone to the depth of ten inches, and set the sills on these; then fill to the top with dry earth. You have thus secured perfect drainage and the best dust bath possible. I know this is not a beautiful structure, but it is comfortable, and by our measure to-day will suffice. On this basis I would advise the farmer to commence to fathom the mysteries of successful poultry breeding.

When these fifty produce ten dozen eggs yearly, double the flock, never forgetting that cares increase in like ratio. Learn the a, b, c of poultry raising before you embark upon the troubled waters, and there will be no cause to regret the step. A man must grow into it slowly, if the full measure of success is to be his. While I am ready to affirm that there is no branch of farm industry yielding such a per cent. as the poultry yard may yield, I should be false to every honest consideration if I failed to present the obstacles to be overcome.

One of the greatest, and one that creeps in unawares, is the pest of vermin. The best treatment is prevention, and that calls for constant watchfulness. In proportion as cleanliness is observed, lice will be kept away. Whitewash often; use kerosene on,

around and underneath the roosts; wash out the laying boxes frequently; provide an abundant dust bath, and vermin can hardly get a foothold. It does n't pay to support an army of these. It costs too much to feed them.

I do not stand here to mislead, but, if possible, to encourage and assist the farmers and small breeders in making the farms of New England more productive and wealthy. The question is not the size of the herd or flock, but the size of the man. One item in poultry breeding is too often entirely overlooked; and that is, the dressing. If floorings are provided under the roosts, and cleaned at least twice a week, the sweepings placed in some dry receptacle, and covered with absorbents, the spring will find you well prepared to economize in the purchase of dressing. Properly protected and prepared, it is one of the most valuable fertilizers we can have, provided it is made from a variety of sound grain. At one dollar a barrel,—the price paid by farmers in my State,—it amounts to nearly forty cents a head yearly, or fully half the cost of keeping. If left under the roosts, its value soon departs, while its bulk is materially reduced.

I have made no attempt to touch the specialties of this feature of farm work, because these have been most ably and exhaustively treated in former papers, by men of long experience and recognized ability. At the request of your Secretary I have attempted a plain, unvarnished tale, from the standpoint of the average farmer. The notable examples to be seen all over this State, showing what men can do when they put themselves heartily into this industry, are proof positive of its value. The line of operations I have attempted to outline, will not give the returns secured by these specialists; but it will surely lead to results perfectly satisfactory to him who patiently works out the problem. There is money in the poultry yard, and it is not so much a difference in breeds as it is in men. Breeds, as I have attempted to show, are what men make them. Men make themselves. Success here, as everywhere, hinges on earnest effort, intelligent appreciation, and patient, persistent application.

Men who reach out after the grandest possibilities, and who labor earnestly and faithfully in any honorable occupation, will realize success. It is not in Arizona or Dakota, but upon the farms of New England, that sure returns come to him who applies himself to this chosen field, conforming his work to the demands of the day, keeping his ear open to the calls of the market, throwing all his energies into the balance for better culture and improved breeds, and himself being builded up in all the essentials of a noble life.

THE FARMS OF VERMONT.

Read by M. O. Howe in the Farmers' Course at the Agricultural College at Burlington.

The subject has a sentimental phase. There is a wealth of poetry to be found about some ofthe farm homesteads of Vermont. In the future some Wordsworth may catch the inspiration of our hillside homes, and make them famous in the literature of the country. But for this occasion we pass by all that, and treat the subject from the most prosy, matter of fact basis, using figures to show the comparative merit of Vermont farms. It is said that figures cannot lie. They can be made, however, to do service for unscrupulous advocates of a wrongful cause. But the statistics I am about to present are from a source from which we get the nearest approximation to actual facts attainable. An individual may see a part of a country, he may be interested in a special product and ignorant as to other products. His opinion of the country, as a whole, is of little value compared to that which is predicated upon complete statistics from actual enumeration.

The enumerators of the census are in general honest and competent men, sworn to the faithful performance of their duties, and the census statistics of agriculture, though not always absolutely correct, are the best attainable evidence of the comparative productiveness of the different sections. They are probably a sufficient approximation to actual facts for all practical purposes, and they prove beyond a reasonable doubt that the farms of Vermont, are, by our value of product, among the most productive in the country. This is contrary to the opinion that has prevailed in other States and at home. We have suffered great loss as a State from the false idea that there is something vastly better for farmers, away in the fertile States of the West; and for young men that choose other occupations, in the great cities outside of Vermont.

In popular estimation Vermont has been included with the six New England States in the view so well expressed in the two lines of the spirited song of Old New England,

> Though *poor* and *rough* her *soil*,
> That scarce repays our spring-time care and toil."

However much our Vermont farmers may complain of poor pay, they get more for their "spring-time care and toil" than the farmers of thirty-six other States and territories, or both the ninth and tenth censuses showing the value of farm product are at fault.

A popular magazine writer, a few years ago, visited Vermont in the Spring, when we were making maple sugar. He came to gather the materials for an illustrated article in Harper's Monthly on sugar-making in Vermont. I quote from his article in Harper's to show the very *common*, but very erroneous, idea of Vermont that, for some unknown reason, has been current both in the conversation and in the literature of the country.

"Vermont," the writer says, "is thought of like Labrador or Alaska, as something within the boundaries of the continent, but aloof from the attributes and intimacy of the commonwealth." He undertook the hazardous journey from New York city up to this Alaska or Labrador of the States against the remonstrance of his family. He passed Troy safely, and describing his journey says:

"We have passed Troy, and still bearing northward, we look out of the car windows on a landscape with a communicative chilliness of color and feeling. The skies are o'ercast by heavy clouds, and the air has a moist penetrativeness; the depots are small and uncomfortable; the soil is scrabby and fallow. The homesteads are seriously unbeautiful; and we detect a dialect in the murmured conversation of the car which convinces us that we are in Vermont."

It was the *dialect* which finally convinced him that he *was in Vermont*. The chilliness of *color*, the small uncomfortable depots, the scrubby and fallow soil, the seriously unbeautiful homesteads, all of these might have failed to convince him that he was actually within the borders of this inhospitable and almost unknown State; but the *dialect* dispelled all lingering doubts. *He was in Vermont.*

Something has been done within the past few years to correct this false impression of Vermont. I talked not long ago with an intelligent Boston lady who has recently bought a farm in Vermont for a summer residence. She has travelled in Europe, spent a season in California at Los Angeles, where they sell irrigated sand at $1000 an acre, visited many places of note in that State, seen much of the western States and territories, and she says that nowhere are the farming class better conditioned, more comfortably situated, than on the pleasant homestead farms of Vermont.

It is in a great part because we have not understood this fact that so many have left Vermont to found homes in the distant States and territories, or to seek to better their condition by joining the rush to the great cities. No other State approaches Vermont in the ratio of emigration to the population. The census shows the nativity or birthplace of every individual in the United States. It shows that there were in 1870 about 178,000 natives of Vermont living in other States and territories. About the same number of natives of Vermont were found living in other States by the census of 1880, and it is probable that the census to be taken next June will show about the same number of native Vermonters in other States. To the number resident in other States should be added the whole number from this State, living in other countries. There are quite a large number in Canada. Vermonters are everywhere. The whole number of non-resident natives of Vermont is probably not less than 200,000. In proportion to the size of the State and the population the emigration from Vermont has been unparalleled. The population of the State by the last census was 332,000. It has not probably changed much since that date. The

registration records of marriages, births, and deaths, indicate a stationary population. The number of pupils in the schools have diminished. But on the other hand, there has been an increase in the number of taxable polls, which, taken alone, would indicate an increase in the population of the State since 1880 of about 15,000. But if there has been any gain it has been in the villages and large places. It is evident that (*for the last twenty years*) the population on the farms has been decreasing. Though the State gained slightly, there was an actual loss during the last census decade of about 2,000 from the farming population, and the loss from this class has probably been greater since that time.

Before I trouble you with my figures I want to notice an objection that is sometimes made to statistics—they are considered dry—especially when used in a public lecture. They are not comprehended when simply caught for an instant from the voice of a speaker. To be appreciated statistics must be seen—dwelt upon—studied and compared. When statistical facts are fully understood, the figures are no longer dry, they become intensely interesting to a mind capable of comprehending their import and weighing their value.

Computing from the figures of the last census, I have prepared a percentage table, showing the per cent. of natives of the State living in other States of the total population of the State. The natives of Vermont living in other States and territories of the United States are equal to 54 per cent. No other State shows nearly so large a per cent. of their population as native non-residents—New Hampshire which comes nearest to Vermont in the number of absent natives of the State, compared with its total population, has a number equal to 37 per cent. of its population who are natives of the State, but non-residents. Ohio has the next largest number of non-residents compared with the total population. The proportion of non-resident natives of Ohio to the total population is 29 per cent. The next in order in the number of absent natives of the State is Maine, 28 per cent.

The non-resident natives of Vermont living in other States are 178,000. The native residents, 252,000. The natives of other States in Vermont are about 40,000. The natives of other countries in Vermont—or foreigners proper—are also about 40,000. Our population of 332,000 is made up of 252,000 plus 40,000 plus 40,000. The whole number of natives of Vermont in the United States is probably about 430,000: The whole number of natives of Vermont in the world is probably about 450,000. Only 58 per cent. of this number live in the State. This is only 8 per cent. more than one-half.

New Hampshire, which next to Vermont has had the largest exodus of its native inhabitants, has 65 per cent. of the people born in the State remaining at home. After New Hampshire there is then no other State that has not more than 70 per cent. of the whole number of natives of the State who are residents of the State.

Maine has 76 per cent. of natives of the State who are residents of Maine.

The facts which are shown in these percentage charts, taken in connection with the unreasoning panic that seems to prevail in many parts of the State to get rid of the farm and to get away from it, is sufficient explanation, if there were no other cause of depreciation in the selling value of farming lands in this State. While farmers have been rushing to the western frontiers of the country by hundreds of thousands annually, it seems never to have occurred to them, or to have been known to any of them, that there was an equal or better opportunity for them here. Vermont has never been thought of as a stopping place, and our own people have joined in the outward rush to an extent not equalled by any other State. The consequence is that we have not people enough to hold possession of the farms and farming lands, except as outlots. Hundreds of good farms have been deserted outright *as homesteads*. Hundreds of excellent farms are for sale without buyers. There are none to buy and occupy them.

In illustration of these facts I will give one out of a great many similar cases that have come to my knowledge. About two years ago a fine river intervale farm in one of the towns of Windham county was advertised for sale in the county papers. The advertisement was kept standing for several months. The farm was also put into the hands of a real estate agent, at Brattleboro, and into hands of another real estate agent in Boston. This farm contained 250 acres—60 acres of river meadows, from which was cut last summer, as estimated, more than sixty tons of hay. The farm was in a very desirable location, near a village, and one-fourth mile from a railroad station and steam saw and grist mill. The house was large, convenient, well-finished from cellar to second story, built in good style, with front projection, two wings, bay window, etc. Noble shade trees stood in front of it. Besides the meadows and pasturage there was a lot of valuable timber on the farm. The advertising of such a farm as this for a year brought not a single buyer. It was then advertised at auction in the county papers and by bills posted in all the neighboring towns. There was a large attendance at the auction, for the personal property and live stock were sold at the same time; but the highest bid that could be obtained for the farm was $2,350! It was finally disposed of in a trade for another farm. The only way that it could be sold for was another farm, or, at least, for another farm in part payment.

A few people in Vermont have thought that it might be damaging to the State to have such facts as these published to the world —that the facts, if known, would tend to depreciate still more the selling value of the farms. I anticipate an entirely different effect. The advertising that Vermont is getting, I believe, will tend greatly to increase the wealth and population of the State. With these facts about the desertion of the State by so many of our own people, we show how little cause there has been for it. With this fact about our low-priced, unsalable farms, we publish the other fact

that these very farms are among the best, the most productive, and the most desirable for homesteads that can be found anywhere in the country. Vermont will bear advertising. Statistics of farm products prove, as far as they can prove anything, that Vermont farms, as a whole, stand very near the head in productiveness.

In the last two United States censuses, those of 1870 and 1880, the value of all farm productions, whether sold or consumed on the farm, was taken. The number of persons in each occupation has been taken in the several censuses. The net profit on the value of the produce of a farm, however, depends somewhat upon the amount of capital invested in the cost of the farm machinery, labor, etc. This consideration makes the showing still more favorable for Vermont, because the capital invested here in land and in machinery is comparatively small.

Secretary Proctor in his letter to the Vermont Association in Boston last week, suggested that "the farms are not abandoned because the land is poor, but only because they raise better men than crops, and good men are in demand."

Vermont has about twice as many cows to each farm as the average to each farm in the Western States. Vermont produces 161 pounds more butter to each person engaged in agriculture than any other State. Vermont makes more than four times as much butter to each person included in farming as the average to each person in the Western States Vermont leads.

Vermont has live stock averaging in value to each person engaged in agriculture $110 more than the average for the United States. Vermont leads thirty-six States in the value of forest products yielded from the farms, without reckoning maple sugar as one of these. Vermont makes more maple sugar than any other State and about one-third of all the maple sugar made in the United States. Vermont generally stands near the head of all the States as to products of agriculture, sown per acre, as shown in the censuses, and in the reports of the Department of Agriculture. It has more than once stood first in the yield of corn per acre. Our State at the head of thirty States and territories in the average of property to each individual. Vermont is a small State. On a two foot map of the United States you can cover Vermont out of sight with the point of the little finger down the first joint. It is about a 300th part of the total area of the United States, not including Alaska. Our products are of course not large when compared with the immense aggregate of the United States, but in that branch of general farming, which has everywhere in a long run proved most profitable, that of dairying and stock raising combined, Vermont stands unquestionably at the head of all the States. Next to Vermont, New York is the best dairy State. It is probable that there is a district in New York equal in area to Vermont that, taken by itself, would be found to fully equal our own State. One or more such districts might be detached from the State of California, some sections of which have famous graz-

ing lands, and the whole State being large enough to make 19 States of the size of Vermont.

We as farmers are not alone interested in keeping up the farms. All business industries decline or flourish in sympathy with the condition of agriculture. The farms must be maintained if other industries prosper. The intimate connection between the condition of agriculture and other kinds of business is forcibly shown by Governor Thayer, of Nebraska in a recent letter petitioning the railroads for lower rates of freight, that would allow the farmers of Kansas and Nebraska to get their corn to market.

The Governor says: "There is so little market for corn that farmers are unable to pay for provision and coal, they cannot meet their obligations; the merchants cannot buy goods because they cannot pay for them; there is an almost universal paralysis of business and every department of human enterprise is blocked and a most gloomy prospect for the opening of spring is settling down upon the people."

In conclusion I quote from a letter from one who has had a home thirty-two years in Iowa; but has travelled much through Nebraska, Minnesota, Dakota and Kansas on business.

Referring back to recent visits in the valleys and among the various hills, there are things there which invite the emigrant if he will think.

"We have considered this question carefully, at this age (fifty-four nearly), have determined that had we the same life to live over as to time, our choice would be back in the valleys by the rippling brooks and under the shadow of mountain ranges."

You have been scanning the country over; you who have passed the meridian of life; you young and ambitious men, there is no brighter future for you at this age and period of human progress than to rest your imaginations upon the things that are within your view, along the Green Mountains. There are no such fields in the West for educational enterprises. There is no field there equal to that of the very country near which you live.

Why should any mortal desire to leave those beautiful scenes, grand influences to live under, grand to meditate in, and glorious even unto death.

INJURIOUS INSECTS.

G. H. PERKINS, Ph. D.

Professor of Natural History in the University of Vermont. Entomologist to the State Agricultural Experiment Station.

METHODS OF PREVENTING OR CHECKING THE ATTACKS OF INJURIOUS INSECTS.—I. INSECT ENEMIES OF INJURIOUS INSECTS.

In order that we may meet the attacks of destructive insects with any chance of success, it is necessary, first, that we understand something of the structure, habits, and mode of development of each species; and, second, that we be able to devise some method by which the enemy may be driven off, or, if possible, exterminated. Usually the war must be one of extermination, for, as every farmer and only too well knows, insects when driven off very often return speedily, and with re-enforcement. Thus the study of insects of insecticides must be carried on together. New insects are every now and then appearing, some of them injurious, some beneficial, some neither. Most injurious insects are attacked in one way or another by other insects. These may be either parasitic upon eggs, larva, pupa or imago, that is, upon any of the different stages which ordinarily occur in the life of insects, and sometimes an injurious insect is attacked in each of these stages by a different enemy. The sudden decrease in the number of insects, which every one has now and then observed, is often due to the destruction caused by parasitic insects. I remember a season some years ago, when canker worms were most ruinously abundant, so much so, that the citizens of the infested town were quite in despair concerning elms and other trees, and the prospects for the next season were certainly discouraging; but, to the agreeable surprise of every one, the next season brought not only no increase of the canker worm, but so very marked a decrease as to well-nigh render efforts for the prevention of further damage to the trees unnecessary, and, for a number of years after this, there was no return of the pest. This deliverance was due to the attacks of certain parasites, which so effectually destroyed the canker worms as to nearly drive

them from the locality. So complete a removal of the evil does not, indeed, often occur, but most of our injurious insects are kept more or less in check by parasites. Some insects are attacked by three or four, or, it may be, ten or twelve parasites. It is obvious that an investigation of this subject of parasitism is of the highest importance. It is, of course, a blind and bungling method of warfare to fight against all insects indiscriminately. We must always remember that there are insects which are of value to the farmer, and the destruction of these is as great a mistake as it is to allow an injurious insect to escape. It is a most fortunate law which seems to prevail throughout the insect world, that vegetable-feeding insects, which are mostly injurious, are almost always attacked by one or more, sometimes many, parasites, and as the pernicious species increase, the parasite is very likely to increase, and often the latter destroys the whole race of the former,

It is not quite easy, without occupying too great space, to give definite descriptions of these parasitic insects which are our friends; but the subject is one of so much importance that, with the aid of the accompanying illustrations, an attempt will be made to give a general idea of some of the more common beneficial insects, although it will not be possible to give anything like a complete account of them, or to even mention more than a few. However, the principal classes are illustrated. Not only parasitic, but predatory insects, those which are the lions and tigers of the insect world, going about seeking the bugs they would devour, must be noticed, and it is sincerely hoped that what information is herein given may be of some assistance in enabling the farmer to distinguish his friends from his foes. The ichneumons, bristle tails, etc., mentioned and figured must serve as types of the groups to which they belong, and, although not strictly correct, yet it will on the whole be safe to consider all similar insects as friends; for, while some of the gall-making insects, as may be seen in figure 6, numbers 21 and 22, which are of this sort, very closely resemble some of the parasitic species, so that they are very likely to be mistaken for them, yet there are not many of them injurious to farm crops, nor likely to be seen about them. For this reason the insects of the sort under consideration which the farmer is most likely to come across, are his friends. Dragon flies devour many small insects, and in all the great groups into which entomologists divide the immense kingdom of the insects, there are some which, by destroying their allies, become most valuable friends to man.

Somewhat resembling in form and closely related entomologically to the ill-smelling black squash bug, there are several insects which are most beneficial.

Figure 1 shows the form of one of these, and figure 2 an enlarged cut of another, which is popularly known as the Spiny Soldier Bug. It is one of the most useful predatory insects, devouring in the larval state plant lice in great numbers, and when fully grown it attacks a great variety of injurious insects, some of them being among our most destructive species. Even the potato beetle finds an enemy in this insect, as does the canker worm and other pests. Figure 3 represents a fly devouring a larva which he has seized. Flies of this group, known as Asilus flies, are beneficial in destroying pernicious insects, but they, unfortunately, do not confine themselves to those that are harmful, but often destroy many bees. Figure 4, as well as figures 5 and 6, illustrate a large group of small, often brilliant-hued beetles, known as Tiger Beetles, and the name is significant of their habits. They may often be seen running briskly over paths or roads in

Figure 1.
SOLDIER BUG.
Acanthocephala femorata. Gl.

Figure 2.
SPINY SOLDIER BUG.
Sinea mltispinosa. De Geer.

Figure 3.
ROBBER FLY.
Erax apicaulis, W.

Figure 4.
TIGER BEETLE.
Tetracha carolina, L.

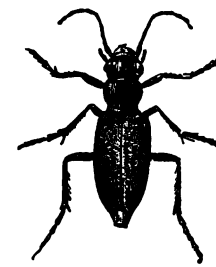


Figure 5.
TIGER BEETLE.
Tetracha Virginica, Hope.

bright warm days. They devour many insects and are to be regarded as beneficial.

Figure 6 gives illustrations of several species of the Tiger Beetles and the larva, with the head of one of them enlarged.

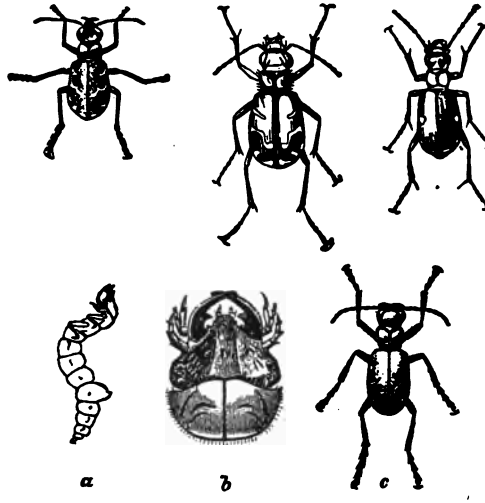


Figure 6.

Cicindelidæ—TIGER BEETLES.

Beginning at the upper right hand corner the species are: *Cicindela hirticollis, Say; Cicindela vulgaris, Say; Cicindela sexguttata, Fabr.* *a.* larva, *b.* head enlarged, *c.* beetle. (After Riley.)

Figure 7 shows the larva and perfect insect of another and larger beetle of similar habits. It is not very uncommon, and is exceedingly useful in destroying some of our most pernicious insects. The beetle is bronze-black, with light reddish bronze spots arranged in rows, as seen in the figure. It is found under stones and in other sheltered places. Among other insects, it destroys the white grub.

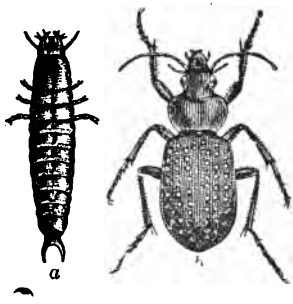


Figure 7.
Callosoma calidum, Fabr.
LARVA and BEETLE.

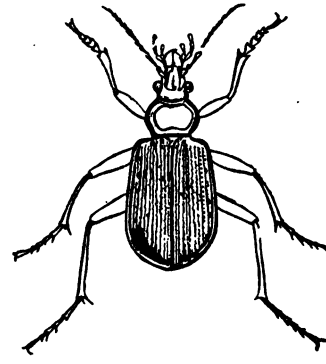


Figure 8.
Callosoma scrutator, Fabr.

Figure 8 illustrates a larger species of this beetle, of similar habits. Dr. Harris commends it for destroying canker worms, even going into the trees after them. If these beetles could be in some way increased so that they should become abundant, it would be a blessing to the farmer.

Figure 9.
Chauliognathus Pennsylvanicus.
SOLDIER BEETLE.
a. Larva; *b.* Larva, head enlarged; *i.* Beetle;
c. d. e. f. g. h. Parts about the head.

Figure 10.
Chauliognathus marginatus.

Another group of thin-winged beetles are serviceable in the same manner as those named. These are sometimes called soldier beetles, though the significance of the name is not very apparent. Figures 9 and 10 show the form of these beetles. Figure 10 is not found in this region. The larvæ feed upon the larvæ of many insects; that of figure 9, among others, eats the larva of the plum *curculio*. Few beneficial insects are more useful than the so-called lady-birds or rose beetles. They belong to a large family known as the *Ceccinellidæ*. These insects will be more fully considered later in this paper, since they are especially valuable as devourers of plant lice.

Figure 11.

Figure 11.
Harpalus caliginosus, Say.
BEETLE and LARVA.

They are frequently seen, often several of them together, about our windows in early spring, and have more than once caused needless alarm because they were mistaken for the dreaded buffalo bug. Several species are seen in figures 59, 60, 61. They feed upon plant lice in both the larval and adult state.

Figure 11, upper figure perfect beetle, lower larva, shows a large and not very uncommon beetle which is especially useful as a devourer of cut worms, although it does not limit itself to this diet, but destroys the larvæ of other insects. Wasps and hornets are disliked by fruit growers because of the injury which they often do to fruit, and they also sometimes destroy bees, but they destroy great numbers of injurious insects, and are to be regarded as highly beneficial. Figure 12 represents a common Wasp. There are many species of very minute flies or fly-like insects, which lay their tiny eggs on or in those of injurious insects, and the egg of the parasite hatching before that of the

Figure 12.
Polistes bellicosus.

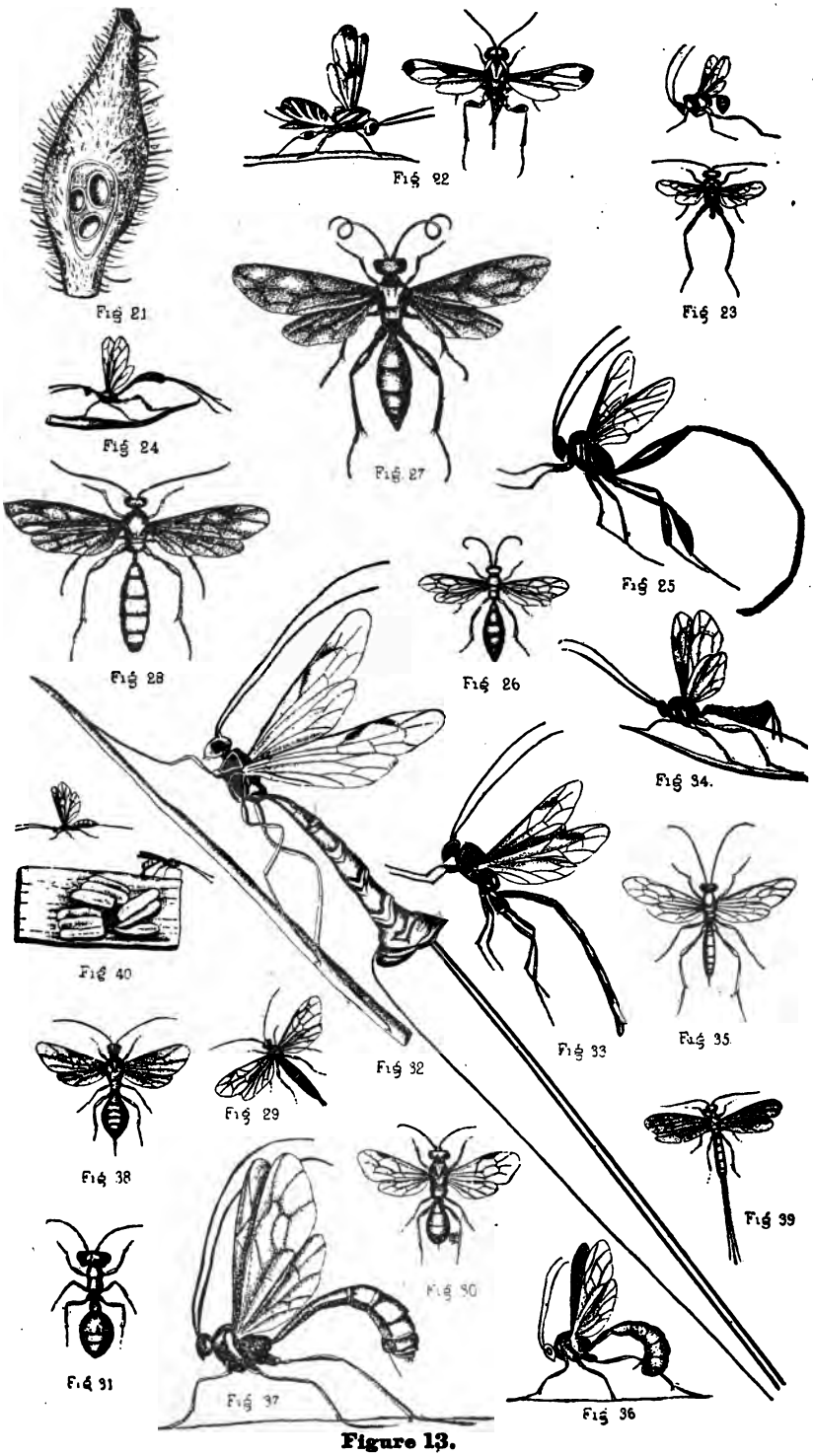


Fig 21
Fig 22
Fig 23
Fig 24
Fig 27
Fig 25
Fig 28
Fig 26
Fig 34.
Fig 40
Fig 33
Fig 35
Fig 32
Fig 29
Fig 38
Fig 39
Fig 30
Fig 31
Fig 37
Fig 36

Figure 13.

host, its larva, thrives upon the surrounding food. They are not true flies, since they have four wings and belong to the same group that contains the bees, ants and wasps.

Most of the figures given above are copied from the papers of Packard, Riley and Comstock.

The full-page plate noted as figure 13, gives numerous examples, taken from a paper by Townsend Glover, of insects, which it is well for the farmer to know.

Figures 21 and 22 are gall-making insects, but figures 23 and 24 are predacious insects, though European; figure 25, an ichneumon, *Pelecinus polycerator*, is not uncommon in New England, and I have several times found it in Burlington. It is probably a beneficial insect; figure 26, *Ichneumon suturalis*, and figure 27, *Ichneumon grandis*, 28, *Trogus exesorius*, figure 29, *Cryptus-inquisitor*, all are parasitic. The eggs of the ichneumons are laid on larvæ or pupæ of various injurious insects, which are thus destroyed, sometimes in large numbers. Figure 30 is a European insect, and also figure 31, both parasites. Figures 32 and 33, *Rhyssa lunator*, *Fab.*, female and male, are parasitic on the *Tremex columba*, which is described later as infesting the elm. It is wonderful how these insects are able to thrust their long, slender ovipositors into the trees after the larvæ of the Tremex upon which its larva feeds. *Pimpla pedalis*, figure 34, is a parasite on the tent caterpillar. Figure 35 is a European insect; figure 36, *Ophion macrurum*, *Linn.*, is a parasite on one of our largest larvæ, that of *Telea polyphemus*; figure 37, *Ophion bilineatus*, *Say*, attacks the common yellow bear caterpillar; figure 38 is a European insect; figure 39 is a Southern species, which, as does that given in figure 40, lays its eggs in the holes made by borers. It will be readily understood that I do not expect the farmers to be able to identify the insects mentioned as well as other family species by these figures, but it has seemed to me that a series of illustrations, such as these given, might prove very helpful in giving farmers some idea, even though it be only a general one, of the general appearance of some of the insects which devour injurious species. While not strictly correct, yet the statement is sufficiently so to be of value, that most of the common insects which have the form and appearance of those given, are beneficial rather than injurious, and to be treated accordingly. As may have been noticed, of the parasitic insects some of them lay their eggs on

the eggs of the injurious species, sometimes on the larva, sometimes on the pupa. Figure 14 illustrates the larva of one of the grapevine moths covered with cocoons of a parasite. Figure 15 shows the adult form of the parasite, both natural size and enlarged.

Figure 14.

Figure 15.

Figure 16, from Packard, shows a fly which is beneficial. It is known as a Tachina fly. These flies are parasitic in caterpillars and other insects. They lay their eggs on the caterpillar, and then hatching, the maggots or larvæ, destroy their nest. I once obtained thirty-nine of these flies from the cocoon of a single Cecropia, and many a collector has been disappointed in trying to obtain a specimen from the cocoon when, instead of the expected moth, he only secured a small swarm of these hairy flies.

Figure 16.
TACHINA FLY AND LARVA.

Figure 17 illustrates another parasitic insect, which is a foe of the cabbage butterfly.

Figure 18 gives another parasitic insect belonging to the Ichneumon tribe. It is destructive to the larvæ of some of the larger moths.

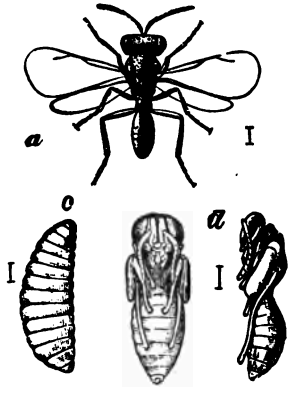


Figure 17.
Pteromalus puparum, L.
a. Male; *b.* Female; *c.* Larva; *d.* Pupa.

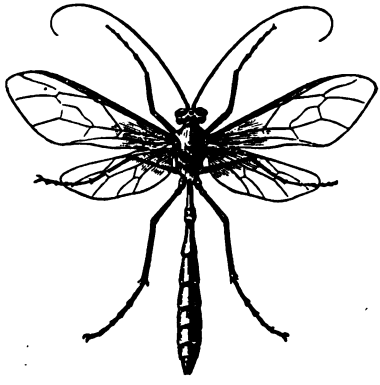


Figure 18.
Ophion macrurum.

II. OTHER ENEMIES OF INJURIOUS INSECTS.

Birds and toads are also of the highest value as insect destroyers. As to birds, their value is more and more fully recognized, and consequently those species which are totally insectivorous are more and more welcomed and protected by the farmer. And as for toads, if anyone will take the trouble to watch them for a time, he will be speedily convinced of their value. It is true that these friends of the farmer are not always as discriminating in their choice of food as is desirable, and too often devour beneficial as well as injurious insects, and on this account their aid is not wholly desirable. Still a very large balance remains to their credit, after all deductions have been made, and he who drives away or destroys either our common insect-eating birds or the toads is making a great mistake. Various quadrupeds, as skunks and raccoons, devour many insects, but probably none are so valuable as the common pig when he has free range. It is a most judicious and beneficial plan

to turn swine into a field which is infested with insects which live in any of their stages in the ground, or which infest fruit which falls to the ground.

III. INSECTICIDES.

Every farmer or fruit grower has long ago discovered that he cannot leave the care of his insect foes to their own special enemies, but must enter the list himself and seek out the best modes of attack. Especially during the last few years has the study of insecticides attracted attention, and many new substances have been tried, some of them very useful, some of them of little value, as proved by ample experiment. Other subtances are yet on trial, and at present it is wise to speak guardedly concerning them, while many new insecticides will undoubtedly appear from time to time. One cause of failure in the use of insecticides has been the improper application of that which in itself was of value. A knowledge, the more complete the better, of the feeding habits, time of appearance and of the different periods of the life of each insect, is essential if the use of insecticides is to be profitable. In more than one instance considerable sums of money and great labor have been thrown away because of mistake in the identity of the insect to be destroyed, because of which remedies useful against one insect were used against another of so different habits that the remedy was wholly unavailing. A notable case of this sort happened some years ago in Baltimore. From the nature of the case no insecticides can be of universal application; some are indeed much more generally useful than others, but none can be satisfactory in all cases. Moreover a remedy highly useful when applied at a certain time, may be of no value whatever when used at another time. The time and method of application are often of the greatest importance. Hence when our fruit or crops are infested, the first thing to do is to discover what is the nature of the destroyer, its habits, mode of growth, etc., and these being known, we may then go on to devise and apply a remedy with some chance of success. If the farmer himself is in doubt of these matters, he is always at liberty to make his wants known at the State Experiment Station, and, so far as possible, the Entomologist of the Station will give all needed information.

ARSENITES.

Of the numerous substances now in use, probably none are more generally useful than the Arsenites, Paris green and London purple. There is still some difference of opinion among entomologists as to the relative merits of these two poisons, and it is quite probable that each has its advantages over the other, one being better in some cases while the other is best in other cases. I have experimented somewhat for several years with both, and find that London purple is on the whole better than Paris green for most purposes, since it is cheaper and quite as effective. These may be used as dry powders diluted with plaster, flour or some similar material, but generally they are more useful when used with water sprinkler or sprayed on the plants or trees. The fact needs to be kept in mind that no solution can be obtained by putting either of the substances into water, only a mixture, and that this may be uniform, not too weak to kill the insects at one time, and so strong as to destroy the foliage at another, it must be frequently stirred, else the poison settles at the bottom of the vessel containing the mixture. As to strength of the mixture, this will vary somewhat with circumstances, but most experimenters agree that a mixture of one pound of London purple and two hundred gallons of water is strong enough for all ordinary purposes and not so strong that it destroys or even greatly injures the foliage. Of course a small quantity could be made in the same proportion, that is, an ounce of purple to twelve gallons of water. Some would use a stronger mixture than this, but probably it would rarely be advisable to use more than one ounce in nine gallons of water. If a second spraying is necessary it should be made with a weaker mixture, that is, one ounce of London purple may be diluted with fifteen or twenty gallons of water. Paris green is heavier than London purple and stronger, containing about ten per cent. more arsenic, but is used in equal bulk. Since the latter is lighter, much more arsenic would be furnished the mixture than the difference indicated would give. Mixtures as strong as one pound of poison to one hundred gallons of water have been used without injury to foliage, but at other times very extensive damage to foliage has followed. According to Prof. A. J. Cook more damage to foliage results from using the poisons late in the season than if used earlier, and "used just before a rain are more harmful than during a drought." Various experiments show that very little of the poison from

sprayed trees falls on the grass beneath, and that there is little danger to animals feeding upon this grass. By far the most satisfactory method of using the mixtures is to spray the trees with them by using any good force pump. A small pump can be bought for from two to six dollars. This will spray a few trees thoroughly if not too large, but for an orchard or any extensive operations a barrow furnished with cask and pump, or still larger a cask on a wagon or truck drawn by horses, will be needed. Several large pump manufactories make a great variety of pumps for spraying trees. If fruit trees are to be sprayed this should not be done until after the flowers have fallen, or there will be danger of destroying all the bees in the immediate neighborhood. There is more difficulty in getting large trees and especially fruit trees, such as plum trees, well sprayed so that enough of the poison adheres to the leaves or fruits to be of use. Whenever this difficulty appears, it may be, at least in part, obviated by mixing about a pound of common wheat flour with every twelve or fifteen gallons of the liquid.

KEROSENE EMULSION.

Next to the above in value probably the various kerosene emulsions should be placed. The object of all of these mixtures is to secure a thorough commingling of the oil with the other liquids so that no free oil shall be found. Very few plants can stand a dose of clear kerosene, although some are not injured by a very moderate amount. I have never sprayed a plant with clear oil and do not expect to do so, but I have used oil drawn from the barrel in one or two desperate cases of mealy-bug, using a soft brush and applying the oil in this way. It must always be a case of kill or cure when such a remedy is used, but it was cure and no appreciable injury in the cases above mentioned. I have also used a mixture of kerosene and carbolic acid, adding many times their bulk of water with good results. but I have no doubt that the kerosene emulsions would have been better, although the mixture used involved much less trouble. Various recipes of making the emulsion of kerosene have been tried and all are good. Prof. Riley's recipe is a mixture of oil and milk of any desired proportions, although that recommended is one gallon of milk, sour is better than sweet, though either will do, and two gallons of kerosene. These must be thoroughly mixed. Very much of the success of the mixture depends upon this. It needs to be well shaken or churned until a

sort of butter is produced. This process may require but a short time or it may need nearly an hour. The warmer the liquid is, up to the boiling point, the sooner the churning is effected. If a stronger mixture is needed the amount of oil can easily be increased in the next lot. In the form of kerosene butter the mixture may be kept indefinitely. When used water is added, from ten to fifteen times as much as the amount of the emulsion used. This can then be put on the plants with a force pump or sprinkled with a watering pot. An emulsion which is perhaps more easily prepared than any other, and is also quite as efficient, if not more so, is one recommended by Prof. A. J. Cook. This is made by taking one quart of soft soap or four ounces of bar soap, and dissolving it in two quarts of boiling water and when the soap, is dissolved and while the solution is hot, a pint of kerosene is poured in. The whole is then vigorously stirred until, when at rest, no oil rises to the top. When used, enough water is added to make fifteen pints, and then it can be applied to the foliage or stems of plants. This can also be used beneficially to destroy lice on domestic animals, although, by some, tobacco water is preferred. I have used an emulsion made substantially like the above on rose bushes with excellent effect. Bushes treated by being thoroughly syringed with the above, using, however, about twice as much water for the final dilution, have been kept free from slugs, and all the other pests so common on roses, while adjoining bushes unsprinkled were left with only skeletonized leaves. A single application may be sufficient, but perhaps it would be better to repeat it a week or two later. If the bushes are well syringed as soon as insects appear fine fresh foliage may be kept as long as the flowers last.

PYRETHRUM.

The Persian insect powder or Pyrethrum is sometimes very valuable and sometimes quite useless. It is often used dry, dusted over the infested plants, but it is easy to see that when used in this way any insectical is much less likely to remain where it is need than if applied wet, and on all accounts it is better to apply it as a mixture with water. A large teaspoonful stirred in a gallon of water makes a good mixture, although for some purposes it may be made stronger. Some of the experiments tried with this mixture have been very successful while others have not been so at all. There are numerous varieties of the powder and some of

the failures have undoubtedly been due to weak powder. It is not at all poisonous, and hence is free from some of the objections which some persons may make to the arsenites; but at best it is not so certain as they are. The pyrethrum has the advantage that it is not necessary that it be eaten; it destroys insects, if it does so at all, by its contact with them. But on this account it is necessary that it be very thoroughly applied, that it may at once reach all the insects. For the green cabbage worm and other soft-bodied insects it is to be recommended.

CARBOLIC ACID.

A dilute solution of carbolic acid (the crude dark sort which can be bought for about seventy-five cents a gallon is good enough) is very good as a remedy for plant lice, mealy bug and such like insects. The strength may vary according to circumstances; but it cannot be used very strong or the foliage will be killed. One part of acid and one hundred of water makes about as strong a mixture as it is safe to use. An emulsion may be made with carbolic acid instead of kerosene, and this is less likely to injure the foliage. It may be made stronger than kerosene emulsion. Prof. Cook's formula, which is certainly good, is as follows: One part of carbolic acid to five or six parts of soap solution. As a remedy for bark lice, borers, and the like, this is very highly recommended. It is to be rubbed over the infested trees, or those liable to be infested, about two weeks after they are in bloom. When it is desirable to use a dry mixture, lime, plaster or any powder may be charged with carbolic acid, one part in fifty well mixed, and then dusted over the plants. Few classes of injurious insects are more difficult to manage than those which remain in the ground the greater part of their life. The white grub is of this sort, and many remedies have been proposed and tried with more or less success, and for the most part the success has been less.

BISULPHIDE OF CARBON.

At present the most promising substance which can be used for the extermination of such insects is bisulphide of carbon. This is a very volatile, ill-smelling liquid, exceedingly inflammable, but not dangerous in any other way. Its value consists in its readily becoming a vapor, which penetrates the soil immediately about the the spot where the liquid is poured, and in the deadly effect which this vapor has upon insects. It is most easily used, all that is nec-

essary being a hole in the infested ground made with stick or bar, into which a little of the liquid is poured and the hole closed by a lump of earth. The liquid, as has just been noticed, speedily becomes a vapor, which extends on all sides for some distance, varying with the nature of the soil, and kills all insects with which it comes in contact. It has been used in Europe in large quantities and with great success for killing root-infesting insects, and of late has been used to a less extent in this country. It may also be used on carpets in closets, or anywhere the housekeeper may discover moths, always providing that no spark of fire shall come in contact with the vapor and that the disagreeable odor can be tolerated. This odor, however, is not without value, for by it the presence of the vapor and the danger from fire can readily be detected. After using it a thorough ventilation removes all danger, and after all it is little, if any, more dangerous than benzine, and more efficacious, though more expensive. In pound bottles it costs about thirty cents, but it is said that in large quantities it can be bought from the makers for about twelve cents. It is not, as hitherto used at any rate, useful against leaf eaters or for spraying, since it is injurious to the foliage and not as certain to kill as the arsenites. This substance is also useful, and carbolic acid and kerosene can be used in the same way, to destroy ants when they become troublesome, by punching a hole in the hill, pouring the liquid into it, and then plugging the opening.

HELLEBORE.

I know of no better agent to use for currant worms, rose slugs, and the like, than the long-tried white hellebore, but as a general insecticide it is not so valuable as some of the others named above. It is very often used as a dry powder, but, like pyrethrum, and indeed all insecticides of which I have any knowledge, it is more easily, and thoroughly, and consequently, more effectually applied as a liquid. One ounce of the hellebore, as purchased, may be mixed with four or five quarts of water, and then be sprayed or sprinkled over the bushes.

COPPERAS.

A solution of copperas in water has been used with good results, in some cases, and as it is so simple and easily procured a remedy, it is worthy of trial. It is of greatest value when used on soft-bodied larvæ, but it may well be tried. The strength need not be great; two ounces in a quart of water would he sufficient.

Much less than this does not destroy many insects and perhaps it had better be stronger rather than weaker. A long list of substances and mixtures might be given in addition to those mentioned, but none of them are of so great value as those given, and most are of doubtful efficacy. Some other substances have had, and still have, more or less reputation among farmers, which are of no value whatever, so far as I can discover, and of course their use involves loss of time and permits the uninjured insects to go on with their ravages. I refer to such remedies as buckwheat flour, fine, dry wood dust, etc. These have been thoroughly tried to no purpose, except the establishing of the fact that they are useless. I have tried these and other substances for cabbage worms more than on any other plants, but I have never seen a worm destroyed or even driven away by them, and yet they have been very confidently recommended time and again. A remedy for plant lice, mealy-bug, etc., which I have tried thoroughly, is in itself so simple that it seems almost absurd: it is simply keeping watch of plants, and when insects appear directing a small stream of water against them until they fall off. For six years the plants in a conservatory have been kept free from the common pests of such a place in this way. In watering by hose nozzle or force pump, all that is needed is that the opening be partly stopped by the finger, in order that a small, forcible stream may be obtained, and this is directed upon infested plants. The shock of the stream so far disables the insects that when once knocked off they rarely have strength to crawl to the leaves again, but if they do the next watering finishes them. I do not see why small shrubs and plants out of doors could not be treated in the same manner. Of course I only recommend this method as useful in case of non-flying, soft insects, such as those named. It is not supposed that it is of any other than limited application, but it has proved very efficient. No very great force of water is needed, since most insects are easily dislodged by a direct stroke, such as the stream would give. I have attempted to free the same sort of plants from insects by fumigating with tobacco and formerly depended chiefly upon this; but, as has been said, for six years nothing but the cold water treatment has been used, and, with far less trouble, the plants have been kept cleaner than in the old way.

STARVATION.

One method of getting rid of troublesome insects always re-

mains when all else has been tried. In case of fruit and other trees starvation is impracticable; but when field crops are attacked, as a last resort this may be tried. That is, the infested field may be allowed to lie fallow for a year or two, in order that there may be no food for the insects. Sometimes a simple change of crop answers the object. To be successful, all farmers in a given locality should act in concert, else starving out on one farm would be of no avail, if the pest were allowed to increase or even exist on those joining, from which the farm freed by starvation would be speedily stocked.

HYDROCYANIC ACID GAS.

Another insecticide has been used with some degree of success in California, where scale insects have been at times very troublesome. By this method only small trees, or those of no great size, can be treated. It consists in covering each tree with a tent made for the purpose and fumigating it with Hydrocyanic acid gas. As described by D. W. Coquillett in *Insect Life* as follows: "It consists in using one part by weight of dry or undissolved potassium cyanide, with one part of sulphuric acid and two parts of water. The generator is made of lead and is somewhat of the form of a common water pail. After the tent is placed over the tree, the necessary quantity of dry cyanide is placed in the generator, the proper quantity of cold water is added, and the generator placed under the tent near the trunk of the tree; the acid is then added to the materials in the generator, a sac thrown over the top of the latter, after which the operator withdraws and a quantity of earth is thrown upon the lower edge of the tent where it rests upon the ground to prevent the escape of the gas. After the expiration of fifteen minutes the tent is removed and placed over another tree." This treatment does not, if care be taken as to quantity of material, etc., injure the foliage or fruit, but does wholly destroy the insects and at no great cost. I have quoted thus fully from Mr. Coquillett's article because the same process is applicable to other trees in other places, and would prove effectual when everything else fails. It should be always used with care and by one who understands fully what he is dealing with, as the gas is exceedingly poisonous, and must not on any account be breathed.

BORDEAUX MIXTURE.

What is known as the Bordeaux Mixture, though not an insecticide, may properly be mentioned here for in combination with poi-

sons it may be both an insecticide and a fungicide. This preparation is made as follows: Six pounds sulphate of copper dissolved in six gallons of hot water, four pounds of unslaked lime are slaked in six gallons of cold water. After the lime is slaked and cool, pour the two solutions together and add ten gallons of water. This proves very useful in preventing rot and other troubles due to fungi, and by adding to the mixture Paris green or London purple, it becomes an insecticide as well.

Besides the methods already mentioned numerous more or less successful experiments are being made in different parts of the country to ascertain the value of various fungi as insecticides. It has been known for a long time that many insects were more or less liable to be attacked by fungi and that they were destroyed by their growth, but it is only recently that any attempt has been made to use this fact and to cultivate the fungi in order that they might be used as insecticides. This has been done thus far only to a limited extent, but it is not impossible that much more may be accomplished in this direction. The spores of fungi are very small, and can be kept for a long time without injury, and when once their growth is started they develop with great rapidity and spread with equal facility from one insect to another, destroying quickly those infested, so that it is possible that a serious outbreak of injurious insects be very effectually and promptly checked by means of fungi.

It has seemed to the writer better to devote the remainder of this paper to a definite group of insects rather than to study various unrelated groups. Hence we will now turn our attention to

---

IV. INSECTS INJURIOUS TO THE AMERICAN ELM.

It will soon be discovered that however limited may be the field of inquiry which the student of injurious insects may adopt, his investigations will necessarily carry him very far beyond the bounds which his subject may at first seem to draw for him. In studying those species of insects which attack the elm, we shall be forced, and very readily, to discuss some of the worst pests which infest fruit trees and other forms of vegetation, so that before we have completed our task we shall find that the fruit grower and the farmer may find that which is of value as well as the lover

of shade trees. It should be noticed here that an abstract of the following pages, with some of the illustrations, has already appeared in the recently published Third Report of the State Agricultural Experiment Station, and the illustrations used in the former paper have been loaned by the Station for use in this. No one should regard these papers, although the subject is similar, as duplicates, for not only is the subject treated somewhat differently in each, but this paper is far more complete than the space which could be given in the Station Report permitted. It has been thought that, as full and complete an account as may be of all the insects known to infest the elm would be useful for reference as well as for the present. Of course, in a paper like this very much is necessarily included for the sake of completeness which is not unknown or unfamiliar, to entomologists at any rate, but not a single species of this sort is mentioned, I believe, which has not been mentioned in letters received from different parts of the State and information respecting it desired. So far as the general subject is concerned, it would seem to the writer that no apology or excuse ought to be needed for investigating the enemies of so noble a tree as the elm, and, while some of the species herein enumerated are at present of comparatively little importance, it is yet more important that they should be at least briefly considered than it may at first thought seem to be, because no experience is more common than that a species of insect hitherto inconspicuous, both as to number and damage done by its ravages, suddenly becomes very conspicuous by its rapid and unaccountable increase. No species of insect is to be passed over as of no possible interest, although we may well devote much greater attention to some than to others. From this, it follows that all observations of farmers, fruit growers and all others are of value, and the great advantage which must result from co-operation in the study of insects is manifest. The very great unlikeness which is found to exist between the young and the adult of most insects, renders the study of their life history the more puzzling and gives additional value to every observation. How great the changes through which an insect may pass during its cycle of existence may be will appear by and by, as we study the Aphides in the last part of this paper. But let us return to the elm. As has been said, no excuse ought to be necessary to justify devoting time and space to the insects that are destroying, or may do so, this tree. It is always easy to understand how any damage to farm

crops affects the finances of those cultivating them, and it is quite natural and proper that those insects which destroy the common and more important farm crops should have especial attention; but it is not right that our attention should be confined to these. Our shade trees have not only beauty, but active value, so that the most thoroughly utilitarian and practical man must yet be interested in their preservation, and there are many who would be very greatly troubled if the familiar shade trees about their homes, or on their farms, were to perish. Very fortunately many of our trees, while not exempt from the plague of insects, are not as liable to destructive attacks as are herbaceous plants. Yet the attacks of insects are sufficiently numerous and ruinous to call for our diligent study. There are, as will be seen in what follows, insects often found on the elms which, if sufficiently numerous, would easily destroy these trees, root and branch, and if we consider what a melancholy change would take place in many of our towns and villages if all the elms were destroyed, we may well feel some anxiety respecting the welfare of these trees, that add so much to the beauty and attractiveness of our State. I have chosen the elm rather than the maple, or any other tree, at this time, partly because the elm seems to me most in danger, and partly because I have been asked to do so by various persons whose opinion and wishes I very highly respect. It may seem an over enthusiastic outburst of admiration to say that the American elm is the finest shade tree known, and opinions may well differ in regard to this, but for myself I believe it to be true that, taking gracefulness, ease of cultivation, variety of form, adaptation to our climate and the physical features of the country, this tree is superior to all others. There are those that are more delicate in leaf, more elegant in flower, more wonderful in this or that respect, but making up a general average, I think we shall find our elm coming out ahead of all the rest. It is rather strange that this tree, like most others, has as its worst enemies, for the most part, very small insects. There are a few large species that more or less commonly attack some part of the tree, but by far the larger part of those insects which injure it are small. This fact makes it all the more difficult to deal with the foes of the elm, since the large size of the tree and the small size of the insect renders the concealment of the latter easy, and the great extent of surface to be reached by any insecticide makes it difficult to apply it with sufficient thoroughness to be of use.

Moreover, many of the insects we are to study are insidious in their method of attack, and ere their presence is noticed, they are so far established that their removal is difficult. It is a fact that our elms are in danger; some have already died, some are sickly from the attacks of insects, some less severely affected are yet infested, and on the way to ruin, so that it is none too soon to give attention to them. General remedies have been considered in the first part of this paper, and most of these are applicable to the elm, but it will be better to speak of specific remedies in connection with specific insects. In Europe over a hundred different species of insects have been described by entomologists which infest the European elm. A less number have thus far been found on the American elm, but in the list which is given on a following page, there will be found a sufficiently powerful array of foes to satisfy the most belligerent. In considering the damage which any insect commits, we must have regard to both the time and method of attack. If an insect like the canker worm eats the leaves of a tree, the injury is greater if done in the early part of the season, as it always is, than it would if done later, so, too, since the living, growing parts of a tree are the new roots, twigs and leaves connected by the outer layer of wood and inner layer of bark, an insect which attacks these is more injurious than one which should attack the heart-wood, and so on.

The following list embraces all the different species of insects which, so far as I have knowledge, attack the elm. I am well aware that such a list is not very interesting in itself, but I hope that it may prove of value to some of those who may read this paper. With the scientific name the common name is given so far as possible. Many of the species have no other name than the scientific. In order to aid those unfamiliar with entomology in the use of the list, I have added after the name of each of the large groups under which the different species are enumerated, a few of the more familiar examples in order that some idea of the character of the group may be gained. For convenience I have arranged the names alphabetically.

LIST OF INSECTS INJURIOUS TO THE ELM.

HYMENOPTERA.

BEES, ANTS, WASPS, ETC.

Cimbex americana, Leach. Elm Saw-fly.
Tremex columba, L. Pigeon tremex.

LEPIDOPTERA.

MOTHS AND BUTTERFLIES.

Anisopteryx vernata, Peck. Canker worm.
Anisopteryx pometaria, Harr. Fall Canker worm.
Anthaxia viridicornis, Say.
Amphidasys cognitaria, Guen.
Apatela americana, Harr.
Apatela grisea, Walk.
Apatela morula, G. and R.
Arctia nais, Drury.
Argyresthia austerella, Zell.
Bactra agutaria, Clem.
Ceratomia amyntor, Hub. The Four-horned Ceratomia.
Clisiocampa americana, Harr. Tent caterpillar.
Chœrodes clemitaria, A. and S.
Empretia stimulea, Clem.
Epirritia dilitata, Hub.
Eugonia subsignaria, Hub.
Grapta interrogationis, Hub. Semicolon Butterfly.
Grapta progne, Cran.
Grapta comma, Harr.
Halesidota caryæ, Harr.
Hyphantria cunea, Drury. Fall Web-worm.
Hyperchiria Io, Fabr. Emperor moth.
Hybernia tilaria, Haw.
Lagoa crispata, Pack.
Lithocolletis ulmella, Cham. Elm leaf primer.
Lithocolletis argentinotella, Cham.
Limacodes scapha, Harr..
Metaneura quercivorana, Guen.

Nepohpteryx undulatella, Clem.
Nephopteryx ulmi-arrosella, Clem.
Orgyia leucostigma, S. and A. Tussock moth.
Ocneria dispar, L. The Gipsy moth.
Parasa chloris, H. Sch.
Paraphia unipunctata, Haw.
Platysamia cecropia, L. Cecropia moth.
Phigalia strigataria, Min.
Paonia excœcatus, A. and S.
Seirodonta bilineata, Pack.
Smerinthus geminatus, Say.
Synchroa punctata, New.
Telea polyphemus, Hub.
Tolype velleda, S. and A.
Vanessa antiopa, L. Mourning cloak Butterfly.
Zeuzera pyrina, Fabr.

COLEOPTERA.

BEETLES.

Cotalpa lanigera, L. Goldsmith Beetle.
Chrysomela scalaris, Le C.
Dularius brevilineus, Say.
Galeruca calmariensis, L. (*Gxanthomelæna*, Sch.) Elm leaf Beetle.
Graptodera chalybea, Ill. Grape vine Flea-beetle.
Hylesinus opaculus, Le C.
Holotrichia crenulata.
Lachnosterna fusca, Frohl. May Beetle. June Bug.
Lachnosterna micans,
Lachnosterna hirticula, Harr.
Magdalis armicollis, Say.
Monocesta coryli, Say.
Neoclytus erythrocephalus, Fabr.
Phloiotrobus liminaris, Harr.
Phyllophaga Georgicana, Gyll.
Phyllophaga pilosicollis, Knoch.
Polyphylla variolosa, Hentz.
Saperda lateralis, Fabr.
Saperda tridentata, Oliv. Elm Borer.
Saperda candida, Fabr.

Sinoxylon basilare, Say.
Trichestis tristis.

ORTHOPTERA.

GRASSHOPPERS, CRICKETS, ETC.

Œcanthus niveus, L. Tree cricket.

HEMIPTERA.

BUGS, PLANT LICE, ETC.

Callipterus ulmifolia, Monell. Elm leaf Aphis.
Colopha ulmicola, Fitch. Cockscomb gall Louse.
Gossyparia ulmi, Geoff. Elm leaf Aphis.
Mytilaspis conchiformis, Bark Louse.
Pemphagus ulmi-fusus, Walsh.
Schizoneura americana, Riley. Elm leaf gall Louse.
Schizoneura ulmi, L.
Schizoneura rileyi, Thomas.
Tetraneura ulmi, Elm gall Louse.

As has been already stated, some of the insects enumerated do little or no harm, but most of them are possibly injurious and many of them very positively so. The only exceptions are a few which live in dead wood. A few of those given in the list are not found in New England, and several others have not yet appeared in Vermont, at least, so far as I know, although some of them may be found here at any time. The order given in the list will not be followed as the different species are taken up more or less in detail, since it is more convenient to adapt a more scientific arrangement.

SAW-FLY OF ELM AND OTHER TREES.

Cimbex Americana, Leach.

This saw-fly is shown in figure 17, copied from one of Dr. Riley's. The figure shows the different stages of the insect, *i.* being the adult male, *f.* the cocoon, *d.* the larvæ first hatched, *e. e.* the full grown larvæ, *a.* leaves of willow showing location of eggs, *c.* a single egg much enlarged, *j.* shows the curious saw-like appendage with which the female cuts slits in which the eggs are placed, *k.* showing the end of the saw still more highly magnified, *g.* shows the pupa in the cocoon, while *h.* shows the same taken

from the cocoon, *b*. shows a twig with slits girdling it, cut by the saw of the perfect insect. The larvæ feed upon the leaves not only of the elm, but also other trees, as willows, birch and basswood. The eggs are laid on the leaves in June, as seen in figure 19 *a*. These eggs soon hatch into larvæ which closely resemble those of many moths, such as the cut worms. They feed for about two

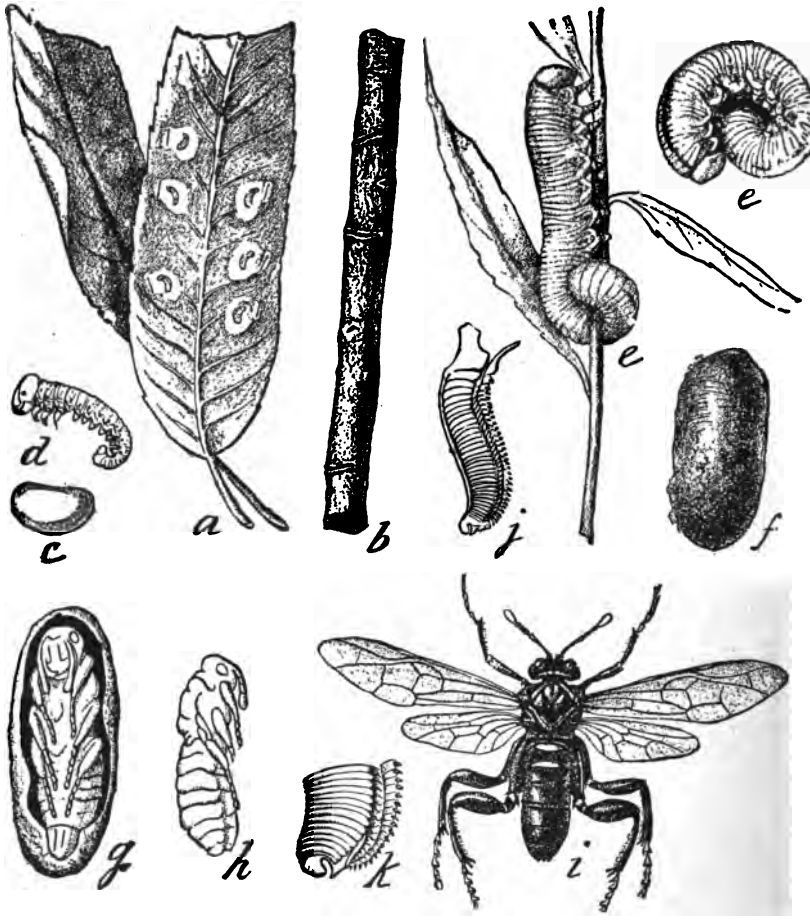


Figure 19.

Cimbex Americana, LEACH.

a. Willow leaves showing deposits of eggs.
b. twig girdled.
c. Egg enlarged.
d. Young larvæ.
e. Full grown larvæ.
f. Cocoon.
g. Chrysalis in cocoon.
h. Chrysalis.
i. Adult fly, male.
j. Saw enlarged.
k. End of saw.
(After Riley.)

months, growing rapidly until fully grown, when they are disagreeable looking, greenish yellow worms about two inches long. When at rest they usually curl themselves as at *e*. figure 19. If molested they can throw jets of liquid from openings along the sides, so that all in all they are unpleasant insects. When they have reached their full growth and development they leave the tree on which they have been feeding and descend to the ground, where they conceal themselves beneath any rubbish that is at hand. Having thus hidden themselves, each forms a tough cocoon, figure 19 *f*., in which it remains during the fall and winter, completing its transformation the following spring. The fly which comes from the cocoon is somewhat like a bee as it buzzes about. It is about an inch long, with wings two inches across when extended. The males and females are not precisely alike, for aside from the saw and ovipositor which the female possesses, she is stouter and the body bears several yellow spots on each side, while that of the male is of a nearly uniform bluish color, and he is somewhat larger than his mate.

The size and voracity of this insect make it a formidable enemy whenever it appears in large numbers, which is sometimes the case. Usually, at least this is true in Vermont, it does not seem to increase very rapidly and does no great damage. The currant worm, one of them, *Nematus*, is allied to the above, though a smaller species. It is, however, an insect which has defoliated large numbers of trees elsewhere, and may at any time need attention here. Any of the remedies suggested for leaf-eating insects, such as spraying with kerosene emulsion, Paris green or London purple and water, would be in all probability sufficient safeguards against this insect. Also, taking advantage of the habits of the insect, it would be well to remove leaves and other debris which might be underneath the trees infested after the larvæ had hidden themselves for the winter, or swine turned out so that they had free access to the trees; or even poultry would destroy many.

PIGEON TREMEX, HORNTAIL.

Tremex columba, L.

This is an allied insect, though quite different in appearance from the foregoing. It is larger, and more wasp-like; within the female a spine projecting from the end of the abdomen. The general colors of the female are black and reddish brown, with

transverse yellow bands across the long cylindrical abdomen. The body is about an inch and-a-half or two inches long, and the dark wings spread about two inches and-a-half. Concealed as in a sheath in the projection from the end of the abdomen is the borer, a black, needle-like rod. By means of this the insect drills holes into the wood of the elm, and in the holes thus formed the eggs are laid. Besides the elm, other trees are visited.

Figure 20.
Larva of TREMEX COLUMBA.

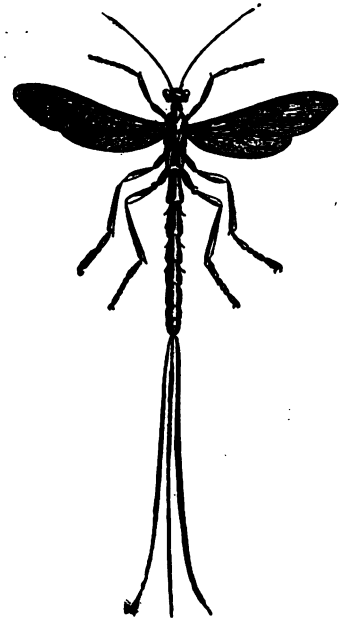


Figure 21.
Rhyssa lunator.

The eggs hatch into a cream colored grub which bores into the wood.

Rhyssa atrata and *Rhyssa lunator*, figure 21, are parasites of the Tremex. By its long ovipositors this insect penetrates the trees infested by Tremex, and places its eggs in or near the burrows, and the larvæ hatching from these destroy the Tremex larvæ. The male Tremex differs from the female, in the absence of the borer, and its shorter body; he also lacks the yellow markings, being reddish brown and black. He is also very much smaller, the expanse of wings being not over two inches, except

in rare cases, and usually it is less. The body is usually about an inch long. I do not think that usually very much damage is done by these horn-tails, nor are they very often found in large numbers.

LEPIDOPTERA.

In the next group, the *Lepidoptera*, there are numerous species injurious to our elms, and many of them also injure other trees. It may be well to remind the farmer that the caterpillars, worms, grubs, or whatever they are called, are the first stage after leaving the egg of moths and butterflies, and that by moth is meant not the insect which is such a trouble to housekeepers, though that is a true moth, but the whole great subdivision of *Lepidoptera*. The moths can ordinarily be distinguished from the butterflies by their loving darkness rather than light; whether because their deeds are evil, as they usually are, or from a natural aversion to the sunshine which the butterflies are so fond of, I cannot explain. They also hold the wings when at rest down over the back, sloping from the middle, showing thus the upper side, while butterflies almost always hold the wings vertically, the upper sides inward, thus showing the outside. The antennæ of moths are usually much more complex and feather-like than those of butterflies. In giving the names of the different species discussed, whenever there is a common name by which the species is known, this will be made prominent, but in many cases there is no other than the scientific name, and of course no other can be given. In most cases the larvæ of the moths do more damage than those of the butterflies, but these latter deserve consideration, and all should have some knowledge of their structure and habits. Several species of butterfly attack the elm, though none of them I believe confines itself exclusively to this diet. There are several quite similar species of butterflies quite common in upland fields and the lower portions of mountains, though found everywhere. They all have the upper surface of the wings of a dark, reddish hue, and the underside mottled and dotted with a mixture of white, black, brown, and gray, which reminds one of a cinder. The edges of the wings are variously scalloped and angled. The largest of these is known as *Grapta* (*Polygonia*) *interrogationis*, Fabr., or *Semicolon Butterfly*. The larva of this butterfly is a little more than an inch long, a cylindrical worm striped with red and black. It is covered with black spines. The head is dark red, two lobed. The butter-

fly appears in May or early June, and a second brood in September or the end of August. The wings on the upper side are shaded with soft, dull red, and mottled with black spots and blotches, which run together near the edge to form a nearly, or quite complete band, outside of which, on the very edge, is a narrow, white band. The under side is dark, ashy gray, very finely mottled. The expanded wings are from two inches and-a-half to three inches across.

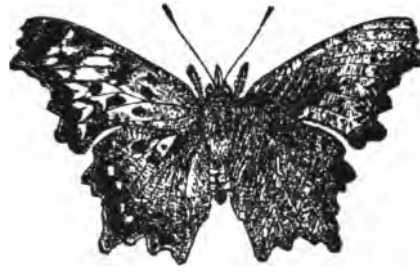


Figure 22.
Grapta progne. Cran.

Grapta progne, Cran., figure 22, is somewhat smaller, rarely exceeding two and-a-quarter inches across the spread wings, and usually being less. It is lighter in shade, though of similar color to the preceding. In the former species there is about the middle of each hind wing, on the under side, a silvery mark shaped like a semicolon—whence the specific name. In this species this mark is more like a letter L. The caterpillar is gray. On the front of each segment is a light stripe, and on each side an oblique black spot, and the body is mottled with gray, while the breathing pores along the sides are marked by yellow spots. It is spiny, like the preceding. *Grapta comma*, Harr., also feeds upon the elm. The colors of the wings are much like those of the foregoing, and its size is about the same. The silvery mark on the under side of the lined wings is shaped like a comma, or like the letter c. The caterpillar varies very much in color at different ages, being much darker when young than when mature. The general colors of the mature larva are white, black, and gray, while a line of red spots marks the position of the breathing pores. Besides the elm, the Graptas feed upon the hop, currant, etc. They are more or less attacked by parasites.

THE MOURNING CLOAK BUTTERFLY.

Vanessa (*Euvanessa*) *antiopa*, L.

This is an interesting species; it is last seen in the fall and first in spring, since it hibernates in the perfect state, spending the cold months in the nooks of barns and out houses, or other places where it finds shelter. Very few of the Lepidoptera remain through the winter in this state, most of them being in the egg or chrysalis at this time. On account of this hibernating habit the butterflies very naturally are seen late in the fall and even a few warm days in winter may arouse them from their torpor and bring them out of their hiding places for a time. The larva of this butterfly, figure 23, is a rather forbidding worm covered with branched black spines. The body is dark, thickly spotted with white dots and along the back there is a row of eight rather large dark red spots. The head is black. When fully grown the caterpillar is an inch and a half long or more. The caterpillar, though such a formidable looking creature, seems to be perfectly harmless. Probably its array of spines serves it a good purpose when toads or birds are about. They feed chiefly on the willows and elm. The perfect insect, figure 24, is a large hand-

Figure 23.
Larva of Vanessa antiopa, L.

Figure 24
Vanessa antiopa, L.
The right wing shows the under side.

some butterfly in form not unlike the Graptas. The general color of the upper side of the wings is reddish maroon, the border is nankeen, while the spots just inside the border are blue. The under side of the wings, shown on the right of the figure, is mottled with grey, black and white. There are two broods each season. The first comes from eggs laid in early spring, and reaches maturity in July. These lay their eggs, and from them comes a second brood in August or early in September and these last, as has been noticed, remain until the following spring. This species is one of the few found in both this country and Europe. The larvæ are not usually very destructive, but sometimes they are sufficiently numerous to do much mischief. A very interesting fact in connection with this insect is found in the stridulation produced by the wings. Very few of the moths and butterflies are known to make any sound whatever, but it has been noticed in a few species that a more or less distinct noise was produced by them when in company with each other. The sound produced by Vanessa antiopa is a grating or scraping sound, and an examination of the fore wings shows an apparatus for producing the sounds which are made by rubbing the fore wings over the hind.

Of the Hawk moths or Sphingidæ there are three species that have been found feeding on the elm, though none are troublesome as a general thing.

A very fine Hawk moth,

Smerinthus excœcatus, *S. and A.*

is found in the larva state on many trees, among them the elm. The front wings are richly shaded with fawn color and brown. The hind wings are of a beautiful shade of rose color in the middle, and bear an eye-like spot the center of which is pale blue. The caterpillar is about two inches and a half long, of a green color, obliquely marked on the sides with white or pale yellow. The whole body is covered with light granulations. It is not common enough to be very injurious.

Smerinthus geminatus, *Say.*

A moth about two inches and a half across the spread wings, is a pretty soft-hued moth of a grayish color on the front wings while the hind wings are very prettily touched with red and bordered with gray. The larvæ is light green, with a curved horn on the caudal portion of the body. The surface of

the body is covered with light granulations which roughen it. There are oblique yellow stripes on each side of the body. It feeds on the apple, willow, elm, ash, plum, birch, etc. Another and much larger hawk moth is the

FOUR-HORNED CERATOMIA.

This elegant moth, *Ceratomia amyntor*, *Hub.*, is four or five inches across the wings; it varies considerably in size. The body is large and stout as compared with the wings, as is always the case with the Hawk moths. The wings are rather narrowly triangular. They are of very beautiful shades of brown, gray and white delicately blended. The larva is a stout warty caterpillar usually about three inches long. It is of a bright green color with oblique light lines on the sides, a row of notches along the back. On the third and fourth ring back of the head are two short stout horns, and a longer one on the caudal end. The whole body is covered with granulations. Sometimes instead of being green these worms are brown, and green and brown ones may be seen feeding together. They finally go into the ground to become chrysalids and remain there until the following spring. The large size of the worms renders them often quite conspicuous, and thus they are readily taken and destroyed, but they sometimes do considerable mischief before they are noticed.

Arctia phalerata, Harris.

This is a rather common and very attractive moth seen in summer about our houses. The front wings are velvety black, crossed by a sort of coarse net-work of light buff lines, the hind wings are tinged with red, and bear several black blotches near the hind margin. The body is buff with black stripes. The expanded wings are about an inch and-a-half across. The larvæ is a black caterpillar, hairy, and with warty prominences over the body, and from these arise short white hairs. There is a line of light yellow along the back. It feeds on a variety of crops, and on the leaves of several trees, including the elm.

THE FALL WEB WORM.

This is one of the pests which it would seem easy to discover promptly and remove, but it sometimes gains such a foothold that much injury is done, whole rows of trees being completely defoliated. Although the individual caterpillars are small, their habit of

feeding in company and protecting themselves with a web makes them often very conspicuous. The adult moth is about an inch and-a-quarter across the expanded wings. *a.* figure 25, *f.* figure 26. It varies somewhat in color, often being pure white, as in figure 26, but also often more or less marked with black, some of the variations being seen in figure 25, which is copied from one of Riley's.

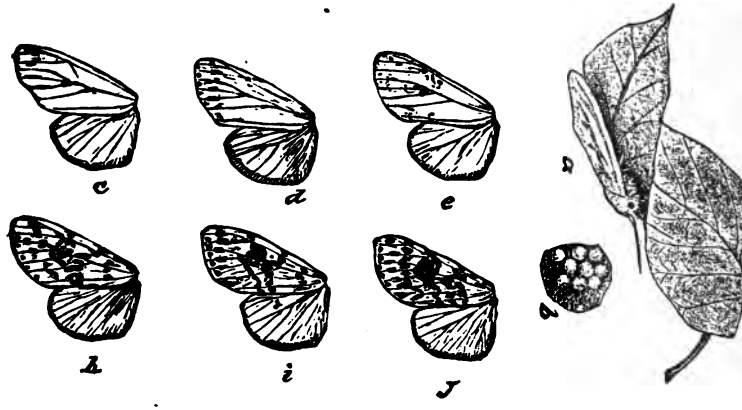


Figure 25.

VARIATION IN MARKING OF WINGS OF FALL WEB WORM.

a. Female resting on a leaf. *b.* Cluster of eggs.

The females lay their eggs early in the summer on a leaf or twig. The eggs hatch during July and August; some of the broods are early and some are late. Soon after hatching, the little worms begin to spin silk threads which form the web beneath the shelter of which they live in companies. These webs may cover a considerable part of a branch. The tent caterpillar uses its web merely as a shelter at night or during stormy days, and leaves it during the feeding time; the web worm differs from it in that it does not leave the web at all until mature. As the leaves covered by the web have been devoured the web is extended over new ones. When the larvæ are full grown they have the general appearance seen in figure 26 *a. b. c.* which shows them enlarged somewhat. As the figure shows, the larva varies in much the same manner as does the moth in coloration; some being bright, others dark. They are about an inch long; the body is rather thinly covered with gray hairs, among which are a few black ones. The general color is yellowish green, dotted or otherwise marked with black. There

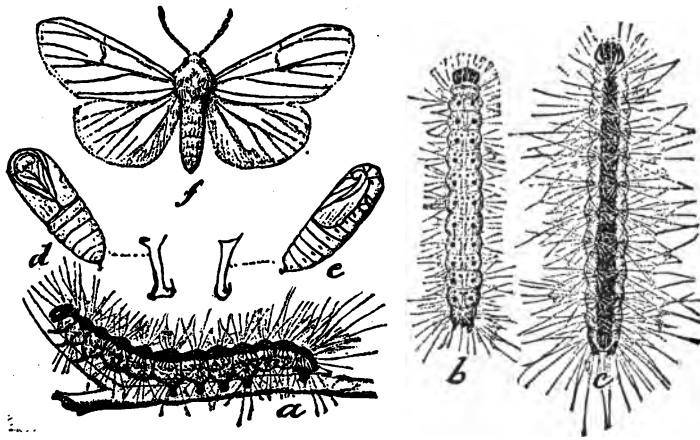


Figure 26.

FALL WEB WORM.

a. b. c. differently marked larvæ. *d, e.* Chrysalids. *f.* Moths.

is a yellow stripe along each side. The head is black and the legs and underside of the body are dark. There are twelve prominences or tubercles on each segment, four black ones on the back and four orange ones on each side. They feed on the elm, apple, pear, cherry, walnut, willow, ash, etc. Toward fall they leave the web and enter the ground where they change to chrysalids, figure 26, *d. e.* Of course the most thorough preventive measure in this case is the prompt removal of the web and destruction of its inmates as soon as it is formed, but it may be and often is overlooked for a time; yet even at the risk of mutilating the tree, there is no better way nor any so good as cutting off and burning the twigs included in the web. The usual remedies for tent caterpillar, burning, soaking with kerosene, are just as useful against this insect, but nothing can take the place of watchfulness, and by reason of this the speedy discovery of the web. Spraying with London purple has proved a cheap and effective remedy, and is perhaps the best when the worms have once gotten established upon a considerable number of trees.

Several insects are parasitic on the fall web-worm. Figure 27

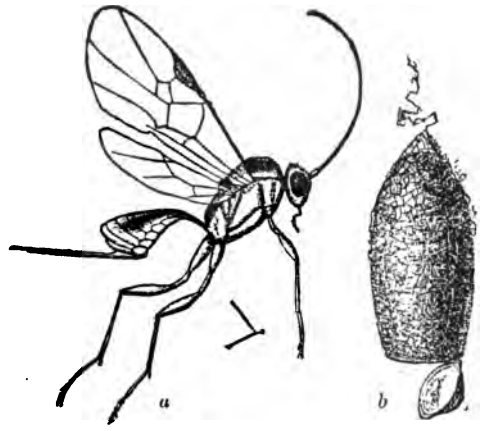


Figure 27.

Metæorus hyphantriæ, RILEY.

shows one of these very much enlarged. Of this Dr. Riley, from whom the figure is taken, says: "This parasite has performed very good service during the caterpillar plague, and has done much to check any further increase of the web-worm." Figure 28 gives

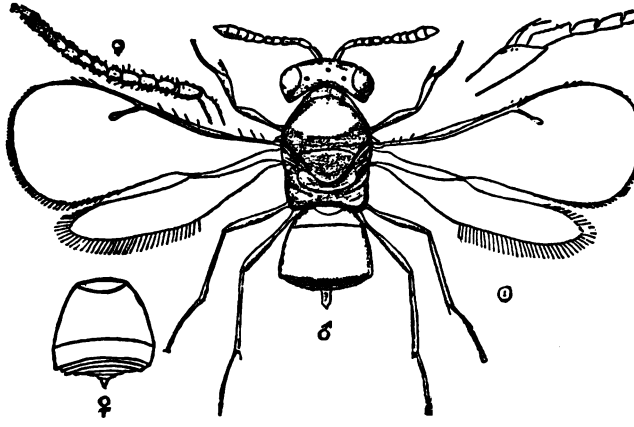


Figure 28.

Telenomus bifidus, RILEY.

another parasite described by Dr. Riley. It is a parasite of the eggs of the web-worm, and the little insect passes all its stages in

the egg, which is of course destroyed. The minute eggs of the parasite are laid inside those of the moth, and hatch there. Dr. Riley mentions three other species of parasites upon the web-worm.

Halesidota caryæ, Harr.

The caterpillars of this moth are sufficiently abundant to entitle them to a popular name, but I do not know that they have any. Their general appearance is not very unlike that of the next species, though they are less gaily colored. They are thickly covered with white hairs in tufts, while along the back there are eight black tufts and smaller tufts of longer black hairs at the ends of the body. The head and underside of the body are black. These caterpillars feed upon walnut, sumach, ash, elm and perhaps other trees. They are sometimes very common and sometimes rare. They are about an inch and a half long when grown. In the last of summer they leave the trees, go to the ground to hide under stones or in crevices. Here they make a hairy cocoon in which they spend the winter. The next June the moths come out. They are rather prettily marked. They are about two inches across the spread wings. The color is light yellow and the front wings are dotted and marked with brown, and there are three irregular rows of almost or quite transparent white spots across them. The hind wings are very delicate and thin, and bear no markings.

THE TUSSOCK MOTH.

This insect, *Orgyia leucostigma*, S. and A., has done much

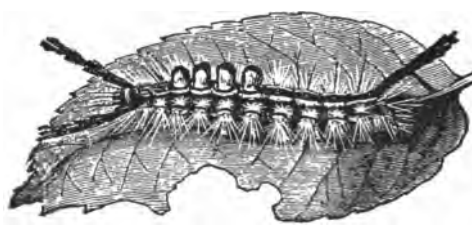


Figure 29.

Larva of Orgyia leucostigma, S. and A.

damage to the elms in some places. The caterpillar, figure 29, is one of the prettiest we see commonly. Like the larva of the

moth just described, it is covered, though rather less completely, with tufts of hair of different color; some tufts being cream color, others black, others yellow. The head is bright red. The general color of the body is yellow. The thick, short tufts of hair seen on the back are yellow or cream color, the long tufts are black and the side tufts are yellow. They usually feed in company and infest various trees; sometimes they are very common on the apple, sometimes on the elm, sometimes on other trees or shrubs. It seems to vary its habits more than most insects do, for although usually a leaf eater it sometimes eats into young apples, and Dr. Lintner gives an account of a very singular variation in habit which occurred in Albany some few years ago. It also varies greatly in abundance, one year being very common and injurious, and then for a year or several years being quite uncommon. In the instance just named, the Orgyias, which had previously attacked the leaves, left these and began to girdle the young growing twigs too; so completely did they accomplish this that great numbers perished and were broken off by the wind, so that the walks were thickly strewed with them. Figure 30, copied from Dr. Lintner's Report, shows how the twigs were eaten. It is remarkable that only elms were girdled in this way. Neighboring trees subject to the ordinary attacks of the insects, such as maples and horse chestnuts, were untouched. Dr. Lintner thinks that the Orgyias were unusually numerous because of the English sparrow. This bird does not at all molest these insects, but does drive off other birds that would devour it. In regard to this Dr. Lintner says, in his second Report as Entomologist of New York: "On the sidewalk in front of two buildings, two large spreading elms standing between two maples showed every leaf eaten from them, disclosing the nesting boxes among their branches and their trunks and limbs dotted thickly, or clustered with the easily recognized egg-bearing cocoons of Orgyia. Hundreds of immature caterpillars were creeping over the trees, fences and walks adjoining," and this in spite of the fact that the nesting boxes named were occupied by English sparrows. After feeding for about a month the larvæ spin cocoons, which they attach to some part of the trees or in places not far away. In from ten days to two weeks the moths emerge. The males and females are very unlike, as figures 31

Figure 30.
Elm twigs girdled by Orgyia.

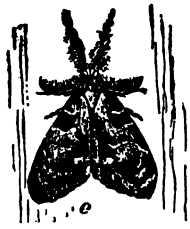


Figure 31.
Male Orgyia.

Figure 32.
Female Orgyia.

and 32 show. The males, figure 31, are like most moths well furnished with wings and they have a peculiar habit of laying back the antennæ, as seen in the figure, and thrusting the fuzzy front legs straight forward. The upper surface of the front wings is in general brownish or grayish with darker markings, while the hind wings, as is very often the case, are of a uniform gray-brown. The females are apparently wingless, of a light gray color. They are of the oval form, shown in figure 32. There are very rudimentary wings which close examination alone reveals. The eggs are laid on the cocoon and covered by a frothy substance, which when dry is white. The worms appear at various times during the season. It appears from Dr. Lintner's observations that the growth of those larvæ which are to become female moths is continued longer than those which become males, nearly a week. The female larvæ molt four times, while the male only three. Since the eggs glued to the cocoons are quite easily recognized, hand picking may be readily resorted to when necessary. The usual remedies against leaf-eating insects can be used with advantage in this case.

The precise scientific name by which an insect is known to entomologists, may not be of very great importance to farmers, and for this reason newer names than some of those given in these pages have not been adopted, since the better known term, so long as it is not really obsolete, is better for our purpose. It should, however, be remarked in passing, that it is not certain that the elm-girdling orgyia are the species *leucostigma* we are considering, but a closely allied species known as *O definata*, Pack. The two species have been very much confused evidently, and may need some overhauling before all is made certain respecting them.

Lagoa crispata, Pack.

The larvæ of this moth appears to feed chiefly on the leaves of

the oak, but it also eats those of the elm. It is a small worm, when mature about an inch long. The head is white, as is the body, over which are scattered tufts of slate colored hairs, and there are also tufts of yellowish hairs. These worms have stinging power, so that if the caterpillar is handled a sharp pricking sensation is felt, and the skin soon becomes red. Of this Dr. Lintner, who has published in the 24th Report N. Y. Museum, a detailed account of the transformations of this species, remarks, "A critical examination of the larva, by a partial removal of its hairs, revealed the existence of clusters of short, slender, acute, white bristles directed upward from the several tubercles of the lateral and subdorsal rows, the presence of which had previously been unnoticed, under their covering of long hairs surrounding and effectually concealing them. Upon touching the bristles with the hand, they were found to be the source of the sting experienced." The larvæ make their cocoons toward the end of summer. The moth is of a dully yellowish red, touched on the sides with drab or slate color.

The stinging property mentioned above is possessed by only a few caterpillars, and is doubtless to these a very serviceable means of defence.

Parasa chloris, *H. Sch.*, is reported by Mr. H. Edwards as feeding upon the elm.

Empretia stimulea, Clem.

A very richly colored moth is sometimes found in the larval state feeding upon the elm. This has no common name, its scientific name being *Empretia stimulea*, *Clem.* It is a rare species, and on that account not especially destructive to the plants upon which it feeds. The moth is a very handsome, dark reddish brown. The wings expand about an inch and a half. The larva is a curiously formed insect, about an inch and a half long, very thick in proportion to the length, and cut off abruptly at each end. The general color is a very pretty, bright shade of green, with a large oval spot of red-brown bordered with a band of white on the back At each end of the body is a larger and a smaller pair of horns, which are covered with spines. These have something of the same poisonous quality as have the spines of *Lagoa* mentioned above. These larvæ feed on quite a variety of plants, the elm among others.

Limacodes scapha, Harris.

The caterpillar of this moth would hardly be recognized as such

by one not an entomologist, for they have little of the appearance of ordinary species. They are rather repulsive, slug-like, and in the present species boat-like larvæ. The general color is green, with spots of brown. The under side is light colored. The moth is a very neatly marked tan colored or reddish brown insect, with a darker brown semi-heart-shaped patch on the upper side of each front wing, bordered by a light line. The larva feeds upon the leaves of fruit trees and several others, including the elm.

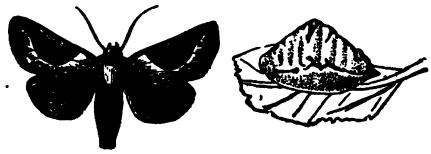


Figure 33.
Limacodes scapha, Pack.
MOTH. LARVA.

Figure 33 shows this moth, and the curiously shaped larva, natural size.

Seirodonta bilineata, *Pack*, is reported as feeding upon the elm and buttonwood. Harris, Ent. Correspondence, p. 301.

The larvæ of several of our large moths feed upon the elm at times, but they cannot ordinarily be considered as very troublesome, for they are rarely so numerous as to do much mischief, and their great size, though this causes them to eat voraciously, yet makes them so conspicuous that they are liable to be seized by birds before they attain maturity. One of the largest is the

POLYPHEMUS MOTH.

Telea polyphemus, *Cram.* The larva of this great moth is not very uncommon, and it has been tried as a silk producer, but without success. It makes silk enough, but it cannot be wound off and utilized. A brief account of this insect must suffice. When mature it is three or four inches long, of a rather delicate green color, with oblique white stripes on the sides. The moth is five or more inches across the wings, which are in general of a russet brown shading to yellowish. Near the center of each wing is an oval transparent spot very conspicuous on the hind wings, where it is surrounded by a black and yellow line. Near the eye spot on the hind wings is a large, beautiful blue spot. About the lower edge of the hind

wings is a light band, above it a dark, and a similar though narrower band crosses the front wings parallel to the outer edge. The whole moth presents a downy appearance, and the colors are beautifully soft. Besides the elm, the larva feeds on maple, hickory, pear, plum, etc., etc.

Our largest and in some respects most elegant moth is the Cecropia.

Platysamia Cecropia, L.

This magnificent insect in soft blending of colors is hardly equalled even among its kindred. The moth is five or six or sometimes seven inches across the wings which are of various shades of grey, brown, red and white. A white band extends across both wings parallel with the the outer border, and in place of the eye-spots of polyphemus there is a little inside of the middle of each wing a large whitish, bean-shaped spot, shaded on the outer margin with dull red, and bordered with black. The margins of the wings are lighter than nearer the body. In Harris' Insects Injurious to Vegetation, may be found a superb engraving of this superb moth. The caterpillar is three or four inches long, of a very pretty shade of green. Each segment of the body bears tubercles from which arise short black hairs or bristles. On top of the second ring these tubercles are bright red, as are those on the third ring; on the seven following rings the tubercles are yellow, and on the eleventh, one large tubercle. Along each side are two rows of light blue tubercles. This is not uncommon in this region, and in the fall its large brown cocoons may be seen hanging to a great variety of trees and bushes. I have taken them often from currant bushes, though they are usually found on larger shrubs or trees.

A much smaller moth, though large as compared with most moths, is what is known as

Hyperchiria io, Fabr.

The larva of this moth is quite a general feeder, eating the leaves of numerous forest trees, as well as a few herbaceous plants. It has stinging spines, which make themselves felt when the insect is roughly handled. Figure 34 gives the general appearance of this caterpillar. As the figure shows, the short stiff spines are in clusters, the clusters being in rows, one about each segment. The

Figure 34.
Larva of Hyperchiria io. Fabr.

color is bright green or sometimes bluish above. The breathing pores along the sides are marked by yellow spots bordered by brown, and below these on each side is a light line. The head is shining green. The spines are some of them yellowish green tipped with black, others are light at the point, some have sharp points, others blunt. Most of them are branched. When fully

Figure 35.
Hyperchiria io, Fabr. male.

grown it is about two inches long. They feed sometimes singly, sometimes in rows. Dr. Lintner mentions finding sixteen "arranged side by side in perfect parallelism," on a leaf of the poplar. They reach their full development about the last of August, and make cocoons in which they remain to appear as moths the next season. The moths, figure 35, male, differ considerably in color according to sex. The males are smaller and of a deep yellow on the front wings, with markings of reddish purple. The hind wings have a border of the same peculiar purple near the body and a narrow band near the outer edge, while there is an eye spot about the middle of each hind wing of dark blue with a white center and a broad black border. The wings are about two inches and a half across. The female is about an inch more across the wings and is of a much darker color, the yellow predominating very little and the general color being a sort of reddish or purplish brown marked with gray. The hind wings are more like those of the male in color but the eye spots are much larger. There is a much larger moth, called by Harris the Imperial moth, which has wings that spread four or five inches, of a yellow quite similar to the male, *io*, and banded with the same reddish purple. Its scientific name is *Eacles imperialis*, Drury. I do not know that its larvæ feed upon elm leaves, and it has, so far as I know, never been reported as doing so, but I suspect it does, for I have taken the moths several times from elm trees, and in parks where no other trees were near at hand and where no oak, walnut, or any of the trees given as those upon which the larva feeds were within a considerable distance. The common tent caterpillar, *Clisiocampa Americana*, is not reported as feeding upon the elm, and I know of but one instance of its doing so. Last year a medium sized elm near my house was infested by this insect, and one quite large nest was allowed to remain till late fall. I have also seen the larvæ upon one or two young elms this summer.

A moth which is not at all common, known as *Tolype velleda*, Stoll., feeds upon the elm as well as upon the apple and oak. The moth is one of the lappet moths, a wooly or fuzzy insect, with white and gray wings, about an inch and a half across in the males, and an inch more in the females. The caterpillar has a bluish-gray body, according to Dr. Lintner, with longitudinal lines. There are scattered parts from which proceed hairs, which

are black on the back and gray on the sides. When fully grown it is more than two inches long.

In *Garden and Forest*, January 15, 1890, Professor Smith publishes an account of a new insect which attacks the elms. It has thus far, I believe, been found no nearer than Newark, N. J. It is an imported species, and although it has been in the country for several years, has only within a short time attracted attention.

This is a pretty moth known to entomologists as *Zeuzera pyrina*, Fabr. Like the preceding, the female is much larger than the male. Her wings spread two and a half inches. According to Professor Smith, the eggs are laid in the forks of the small branches, and "the young larva burrows downward toward the larger branches, tunneling generally through the center, and usually killing the branch." The larva grows until it is over an inch long. It is a white worm, dotted with black, and from each dot comes a black hair. This insect appears to have gained a foothold about Newark, and to be spreading. The only remedy seems to be to cut off and destroy the infested twigs. Several species of the germs *Apatela* feed upon the leaves of the elm.

Apatela americana, Harr.

This is a gray moth, two or two and a half inches across the spread wings. The general color of the front wings is a soft, rather light gray, marked, as the figure shows, with lines and blotches of darker color. The light marginal line is also seen. There are also spots of lighter color scattered over the surface. The broad wings are of nearly uniform color, but darker than the front ones, especially in the female. The caterpillar is hairy, rather large, being, when full grown, two inches and a half long. Its general color is dark greenish, varying to blackish, the head being brown. Besides numerous yellowish, bristle-like hairs, there are longer tufts of black hair, one near the hind end of the body on the eleventh ring, and two on the fourth, and two more on the sixth ring. The feet are black. It appears late in summer, and does not reach its full size until fall. It then goes into a chink, crevice, or any suitable shelter, and changes to a chrysalis, in which it remains until the following summer. These caterpillars feed upon the leaves of the maple, poplar, chestnut, basswood and elm, and perhaps other trees.

Another species, *Apatela morula*, G. and R., was some years

ago described by Dr. Harris, under the specific name *ulmi*, from *Ulmus*, the generic name of the elm, on which Dr. Harris thought it fed. The larva is described by Dr. Lintner in the twenty-sixth Report of the New York State Museum. It quite closely resembles the bark of trees, on which it rests. It is smaller and lighter in color than the preceding. It appears to be a rare species, and Lintner thinks that it feeds only at night. *Apatela grisea*, Walk., is reported as feeding upon the leaves of the elm.

Eugonia (*Ennomos*,) *subsignaria*, Pack.

A very delicate white moth, figure 37, which is about an inch and a half across the expanded wings; is sometimes quite injurious to the elm.

Figure 37.
Eugonia subsignaria, Pack.

The caterpillar is a slender measuring worm, rather more than an inch long, of a dark brown color, with a reddish head. They by no means confine themselves to the elm, but are quite general feeders. There is no common name; the scientific name is given above. Another measuring worm is the larva of a very pretty little moth.

Metanema quercivoraria, Guer.

As the specific name, from *quercus*, oak, indicates, this caterpillar is especially fond of oak leaves, but it is also found on the elm. It is a light green worm with reddish markings.

Paraphia unipunctaria, Haw.

Another measuring worm is mentioned by Dr. Packard, as follows: "Eating the leaves in June; a gray span worm, an inch

and a half long, sprinkled with black dots and short lines, its head and neck a little thicker than the body, each ring with a small, squarish white spot above on its hind edge, and with two blackish parallel lines on each side of this spot." The moth is a light brown or fawn colored insect, paler on the under side. It is about an inch and a half across the spread wings.

An uncommon moth, *Chœrodes clemitaria*, A. and S., which feeds in the caterpillar state upon the various plants—also eats the elm. It is a Southern species, and not likely to occur here. The moth is buff or tan color; on the wings dotted with black. The larva is a light reddish, measuring worm, the body being dotted with brown.

An insect which in many respects is like the canker worm, though usually less common is

Hybernia tilaria, Harris.

It is, however, a larger and more showy insect, as figure 38 shows, at least the male is, for the female, like that of the canker

Figure 38.
Hybernia Tilaria, Harris.
Larvæ Feeding, Winged Male, Wingless Female.

worm, is wingless, and while her mate flies about with entire freedom, she is compelled to creep in a rather abject manner.

The male (upper figure) is of a yellowish color, shaded with spots of brown, and, as may be noticed in the figure, there is a very brown line across the front wings. The hind wings are brown, and not spotted or marked. The female is of the somewhat oval form shown in figure 38. She is of a light yellow or even white color, with a double row of black spots along the back. The larva is a measuring worm about an inch or an inch and a quarter long. Its body is yellow, with ten longitudinal black stripes, and there are sometimes dark spots. The head is reddish brown, and the under side of the body is yellow. It feeds on the leaves of the basswood, elm, and a great variety of other trees. After feeding in May and June the larvæ descend from the trees by means of a silk thread by which they let themselves down to the ground. They enter the earth and make a cell a little below the surface, and remain as pupæ until the last of October or later, when the moths appear. The female seeks to creep up the trunk of some adjacent tree that she may place her eggs near the ends of the branches, where they may remain to hatch the following spring. The habits of this moth are so much like those of the canker worm, that the remedies recommended for that insect may be applied to this.

This group of geometers or measuring worms to which the insects we are now studying belong, is a very large and very interesting one.

The caterpillars belonging to it vary a good deal in form, size, etc., and yet they may, for the most part, be readily recognized by their peculiar way of measuring their length along as they creep. Instead of moving with the gliding or undulating motion of most caterpillars, these cling by the front or true feet, and loop up the back until the hind or false feet are brought up to the front ones, then the front part of the body is thrust forward until the back is again straight, and thus by alternating looping and extending, they move along. As has been noticed, the group or family of measuring worms is a very large one, embracing hundreds of species. One of these measuring worms is called

Amphidasys cognitaria, Guen.

I do not think it has any common name. The moth is white, "very thickly sprinkled with ashy black," Packard. The larva is

a dark brown, or greenish worm, rather thicker than most of the group. The body is dotted with light tubercles, and there are

Figure 39.
Amphidasys cognitaria, Guen.

numerous short, black hairs. Figure 39 shows the moth of this species. The larva feeds upon the leaves of currant and other

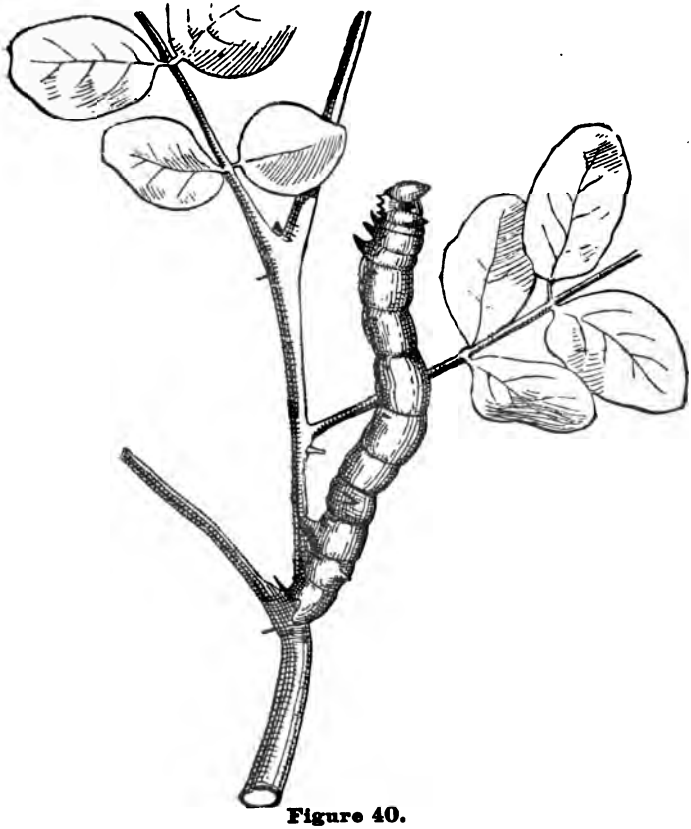


Figure 40.
Larva of Amphidasys cognitaria.

shrubs, as well as those of the elm. After feeding for some weeks, the larvæ descend to the ground, in which it changes to a pupa, coming out as a moth the following spring. The moth is about two inches across the spread wings. Figure 40 shows the larva feeding, copied from Dr. Lintner.

CANKER WORMS.

These familiar, and often most troublesome pests, often commit great ravages upon the foliage of the elm. We have two quite similar species of canker worms, which may be designated as the spring canker worm, and the fall canker worm. Both are very mischievous insects, but the spring species has been most so, and in the many places no enemy of the elm has committed greater apparent ravages, although these are of such a nature that if they are not too long continued, the trees usually recover much of their original vigor in a few seasons.

THE SPRING CANKER WORM.

Aristopteryx vernata, *Peck*, sometimes occurs in such numbers that the trees are entirely stripped of their leaves. I have seen rows of great elms as bare in June as they ordinarily are in December. Fruit growers, also, are usually made aware of the presence of this pest before they have had many years of experience.

Figure 41.

Anisopteryx vernata.

a. Male. *b*. Female.

The only really redeeming quality which the canker worm possesses is the clumsy, wingless, and therefore immobile character of the female. A few species of moths are found in which, although the males have fully developed wings, and are very active, the females are destitute of wings and can only creep slowly from place

to place. Had the females of these moths the same well developed locomotive powers as have their mates they would be even greater and more terrible scourges than now. The sluggishness of the females limits the range and checks the increase of these pests so that bad as they often are we may be thankful that they are no worse. The general form of the male and female canker worm is seen in figure 41, *a*. the male, *b*. the female. This insect has been often described and need not occupy great space here. It will suffice to call attention to the delicate, exquisitely fringed wings of the male, which are of a satiny luster, and light brown color. The front pair as seen in the figure, are darker than the hinder pair and are crossed by more or less distinct wavy dark lines, and there is a band of very light, almost or sometimes quite confluent, spots near the outer margin of each front wing. The wingless female is more or less wholly covered with scales and hairs of a light brown shade, and as may be seen in the figure there is a wide black or dark line extending along the back, *d*. figure 42, shows the upper surface of one of the rings magnified; *e*. is the ovipositor enlarged; *c*. a part of one of the antennæ.

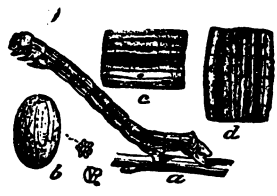


Figure 42.
Anisopteryx vernata.
Egg and larva.

In the spring before the leafbuds unfold the moths emerge from the chrysalids in the ground. The females instinctively creep toward the nearest trees and slowly ascend their trunks, the males fluttering about them and pairing takes place during the ascent. If her progress is uninterrupted the female reaches the leafbuds and places her eggs, figure 42 *b*., greatly enlarged, on or near them. The eggs are usually laid in clusters. Sometimes the eggs are concealed in crevices of the bark. The eggs hatch as the leaves unfold and the young worms at once begin to devour them, growing large as the leaves grow less. About the last of June the

worms reach their full growth and are slender measuring worms, about an inch and a half long, figure 42 *a*. When first hatched the head is glossy black and the body dark green or olive; but during successive molts the color grows lighter, the head is not uniformly colored, but spotted. Along the body there are eight more or less distinct lines or bands of a lighter color than the rest of the body, as shown in the magnified section of the back, figure 42 *d*., and of the side, figure 42 *c*., but the markings are far from constant, different specimens showing great variation. When mature the worms creep, or very often lower themselves from the trees by a filament of silk. I have seen trees from which during the last week in June the worms were hanging by hundreds and dropping to the ground. Having reached the ground the worms burrow a few inches, then they turn and work themselves about until a sort of cell is formed and in this they change to pupæ, and remain through the winter, for the most part emerging, as we have seen, the next spring. It is obvious to any one that any method which can be devised to prevent the female from ascending the trees and placing her eggs near the leafbuds will effectually check the increase of the insect, since the young must perish unless they speedily find proper food at hand when they hatch, and most of the remedies which have been proposed have sought to accomplish this. Various appliances have been tried, but none seem more satisfactory than simple bands covered with some sticky substance that will remain sticky in all weather. Probably that recommended by Dr. Packard, cheap printer's ink, is as good as anything and better than most; coarse molasses or tar and oil are good. Mr. Saunders says that if the worms are found on a tree they may be removed by jarring them off in the same manner as that used to get rid of curculias. Spraying with poisonous liquids would destroy many, and when once established on a tree, this method would probably be better than any other. Various parasites attack the canker worm. One, figure 43 which shows it greatly magnified, has often proved most helpful in this respect, so than I have known seasons in which the trees were very seriously affected, to be followed by one in which there was scarcely one to be seen, and the chief agent of destruction was this little parasite, which is one of the tiniest of insets. It lays its eggs, one in each of the eggs of the canker

Figure 43.
Egg Parasite of Canker Worm.

worm, and the larva hatching devours the egg substance about it. Many of these worms are devoured by the beetle shown in figure 7. Toads devour many of them; cedar birds and other birds also destroy many. It should be noticed that if bands about the tree are used they should be in place early in the spring, and as some escape from the ground and lay their eggs in the fall it is well to apply them also in October, when they may remain all winter.

The fall canker worm is very similar in appearance to the species just described, and was long confounded with it. Dr. Riley, from whose paper the accompanying cuts are taken, first showed the differences between the species with such fullness and accuracy that they could, in most cases, be easily separated; and the distinction is an important one, because the remedies applied and the mode of application differ somewhat in the two cases, as there is difference in their habits.

THE FALL CANKER WORM.

Anisopteryx pometaria, Harr., is found, not only in the fall, but throughout the season in one form or another. The moths of Anisopteryx vernata, though generally appearing in the spring, may appear in the fall, or even in winter during several warm

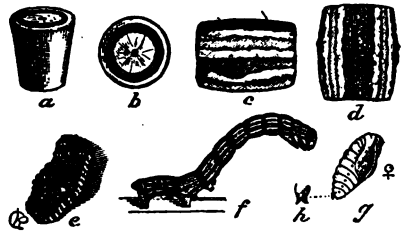


Figure 44.
Anisopteryx pometaria, Harr.
Eggs, Larva and Chrysalis.

days, but the *Anisopteryx pometaria* only appear in the fall and, after laying their eggs, perish. This latter species is not so generally injurious as the spring canker worm, for they are not so general feeders, confining themselves mostly to the elm, although they feed also upon apple and pear trees. Although the eggs are laid at different times, they hatch at about the same time in the spring. The egg of the fall canker worm differs very greatly in form and appearance from the other species, as a comparison of

figure 44 *a.* and *b.*, with figure 42 *b.* shows at once. They are laid in larger and more conspicuous clusters, and are not often concealed, as are those of the common canker worm. The larvæ are less readily distinguished, although they can generally be separated. As seen in figure 44, *c. d. f.*, as compared with figure 42, *c. d. a.*, the markings along the back are less numerous. The head is darker in the fall canker worm, and the larvæ when first hatched are lighter green. They feed alike on the leaves of the food plants as they unfold in the spring. The first described species in all cases, I believe, does greater damage than the other, as it is most abundant.

As shown in figure 45, *b.*, the female is wingless, the body is smoother and rather more slender than in *a.*, vernata, and has not the dark median band. The general color is a dark gray. Figure 45 shows the magnified surface of the back, and this may be compared with figure 45, *d.*, to show the difference in the two species.

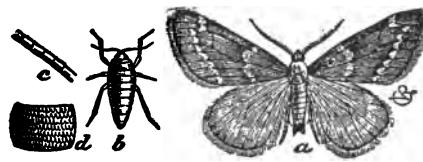


Figure 45.
Anisopteryx pometaria, Harr.
FALL CANKER WORM.
Adult forms, *a.* male, *b.* female.

The male, figure 45, *a.*, of the fall canker worm, is darker than that of the other species, though closely resembling it. Other differences, as well as many resemblances, will be noticed on comparing the figures of one species with those of the other. So far as preventive measures go, I wish to notice that although so similar, the two species require dissimilar treatment. Says Dr. Riley in this connection: "In brief, all the more important measures to be pursued in our warfare against the spring canker worm, such as hindrances to the ascending of the moths in the spring, the removal of loose bark, and keeping the trunk and limbs as smooth and clean as possible, the employment of hogs and fall plowing are in the main useless as directed against the fall canker worm, which must be fought principally by traps or barriers applied to

the trees in the fall to prevent the climbing of the moths, which mostly issue at that season." (Riley, 8th Report, p 18.) It is all the more important that when either of the canker worms appear, it shall be at once met by insecticides and preventive measures because of the slow progress which the female is able to make from one tree to another, the rapid increase of the pest being thus an impossibility, and if it can be destroyed in the limited region in which it has established itself, the whole adjoining region may be free from it for a very long time.

The larva of a very elegant moth known as

Epirrita dilutata, Pack.

devours the leaves of many of our forest trees, and is at times a foe to the elm. The larva fig is a measuring worm of a greenish color, lighter underneath, and there is a light line along each side. These are often purplish on the wings. It is a subarctic species, and not likely to be common here. The moth is of a general grayish color, dark and light shades are very finely intermingled. The wings have a spread of rather more than an inch and a half. Chambers in a paper "On food plants of Tineina, (Hayden Bulletin IV. 117,) says of *Argyresthia austerella*, Zeller, I am convinced, feeds in some way on it, (American elm,) and in the latter part of May and in June the imago may be found about the trees. *Bactra argutaria*, *Clem.*, is reported as feeding on the elm.

There is a group of very small delicate moths, which in the larvæ state burrow in the leaves of various plants. They are very handsome little insects. The moths are long and narrow, and the hind wings are finely fringed. The larvæ feed especially upon the middle part of the leaves, and sometimes, indeed, often the presence of the miner is betrayed by a folding or crumpling of the leaf, although if the mine is mainly on the under side of the leaf, it does not fold, but is simply discolored. The little larva spends its life in the burrow, and transforms into a pupa there. Two species infest elm leaves, known respectively as *Lithocolletis ulmella*, *Cham.*, *Lithocolletis argentinotella*, *Clem.*

Ocneria dispar, L.

a moth well known in Europe, has appeared in Massachusetts, and is the subject of a special Bulletin by Prof. Fernald. It has a wide range in the Old World. It appears to be quite a varied

feeder, sometimes leaving the trees and attacking the vegetables in gardens. Thus far it is confined to a limited area in Massachusetts, and as vigorous efforts are being made to destroy it, we may hope that it will spread no further. The moth, commonly known as the Gipsy moth, is of considerable size, being sometimes two and a half inches across the wings, although it varies considerably in size, and is often much less than this, while the males are nearly an inch less than the female. The wings on the female are light yellow with brown scalloped lines crossing the front wings, and a row of black spots along the outer edge. The hind wings are of uniform color, except at the edge, where there is an irregular band or row of blotches. The eggs are placed on the branches of the trees in late summer, and hatch the next spring into caterpillars, which feed upon the leaves of trees, and finally become nearly two inches long, of a dark color, marked with light yellow, and there is a line of yellow spots along the back; along the sides are long tufted hairs.

COLEOPTERA, OR BEETLES.

This gigantic group very naturally includes quite a number of species that infest the elm. Some of these are among the worst enemies of this tree; others, though more or less injurious to the elm, are much more so to other trees or plants. As was shown in the first part of this article, many beetles are to be regarded as friends, since they destroy many injurious insects. The common and sometimes very troublesome

GRAPEVINE FLEA BEETLE,

occasionally attacks the elm. This little beetle *Graptodera chalybea*, *Ill.*, is injurious not only in the larval, but also in the perfect, state. As they come from their hiding places in early spring, the beetles attack the unfolding leaves. They remain but a short time, but the eggs which they deposit on the leaves soon hatch, and the larvæ continue the work of devastation with increased vigor.

Figure 46 shows the various stages of this beetle, and its bright, metallic blue wings and body are sufficiently familiar, especially to vine growers to render a detailed description unnecessary. Air slaked lime dusted over the infested leaves, kerosene emulsion, arsenical mixtures properly, are generally effective remedies.

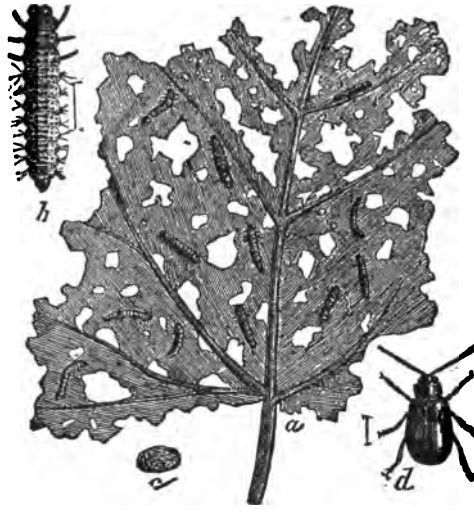


Figure 46.

Graptodera chalybea, Ill.

a. Larva feeding; *b.* Larva enlarged; *c.* Pupa cell; *d.* Beetle enlarged.

Cotalpa lanigera. L.

This is a large golden-bronze beetle, not usually found except in the southern part of the State. It does not do very much damage to the elm. The larva of this bettle is much like the common white grub and, like it, feeds in the ground. It attacks the elm and other trees only in the perfect state.

MAY BEETLE, JUNE BUG.

This beetle, the larva of which is the too well known white grub, is much less harmful to the elm than to those plants which it attacks in the larval state by devouring their roots, yet when the beetles are as abundant as they are sometimes, they destroy no small number of young leaves of our common shade and fruit trees as they fly about them at night in May or June. This beetle *Lachnosterna fusca*, *Frohl.* was described, and remedies suggested in the Second Report of the Vermont Experiment Station, but as no figures are given in that paper, they are given here from a cut obtained for the Third Report. The figures are natural size and give a very good idea of the insect. It is important that as many of the beetles be destroyed as possible, for this will tend to

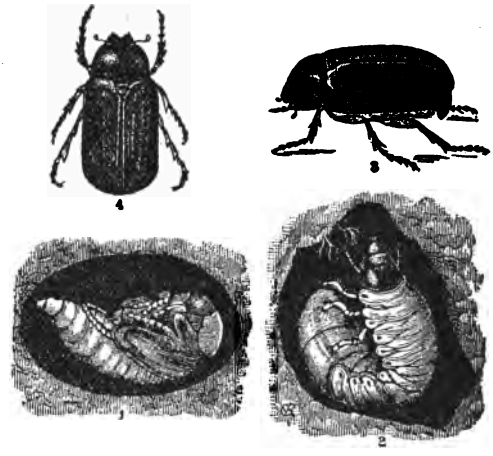


Figure 47.

MAY BEETLE.

1 Chrysalis in the ground. 2. larva feeding. 3 and 4. beetles.

lessen the number of white grubs, which is the form shown as 2 figure 46. Where the white grub is abundant in the ground it is often very difficult to reach it by any remedies, so much so that some of our best entomologists have recommended starvation by leaving the land untilled for one or two seasons. In the last Report of the Experiment Station a new remedy has been recommended which, I have strong hope, will prove efficacious and not very costly, although further experiments are needed to determine just the best method of application. This remedy is bisulphide of carbon, a liquid in some respects like benzine or gasoline, in that it readily vaporizes, and the vapor is destructive to insects. It is very evil smelling and very inflammable, so that those using it need to keep continually in mind the fact that no spark of fire can be allowed to come in contact with the vapor, if it does, explosion and injury is likely to follow. In using it, holes should be made in the ground with a small bar of wood or iron, a teaspoonful or two of the fluid poured in, the opening stopped with a lump of clay or anything of the sort. The volatile nature of the bisulphide causes it to change rapidly from fluid to vapor and penetrate the surrounding earth and destroy such insects, white grubs, wire worms etc., as may be within reach. Just how far apart and how deep the holes should be, must depend upon the nature of the soil and other local conditions, and must be determined by experiments in different

localities, but in general it may be said that they need not be very deep, for the vapor is heavier than air, and will go down as well as up, and as a rule the white grub feeds only a little below the surface. As to distance apart, the holes should be not more than three or four feet from each other but the wisest course would be to try a small bit of ground first and see what the effect is. In Europe the bisulphide is used by the ton for the destruction of phylloxera on grape roots, and with very good success. Should the demand for bisulphide increase as I think it certainly will, it will be possible to buy it much cheaper than now. At present in one pound cans or bottles it costs about twenty-five cents, but it can be bought in larger quantities from the manufacturers for almost half this or even less.

Mr. W. B. Alwood makes a report in Insect Life, vol. 1, page 48, on the use of kerosene emulsion for the white grub. The emulsion used was made by taking ten gallons of oil, and five pounds of soap, which when diluted with water made three hundred gallons. "This was applied liberally to the soil, which was for some days kept freely soaked with the mixture." No serious injury to the grass resulted, and the grubs were effectually driven away, or destroyed. This is a very simple and easily applied remedy, and is worthy of consideration.

In a paper on the "Food and Habits of Beetles," published by Mr. Townend Glover, in Reports of Department of Agriculture, 1868, *Lachnosterna micans*, *Lachnosterna hirticoila*, *Holotrichia crenulata*, *Trichestes tristis*, are mentioned as feeding upon the foliage of the elm. Another somewhat similar beetle is one known as *Polyphylla variolosa*, Hentz., which is found near the coast, but is not common in New England inland. It is a light brown beetle, about an inch long, with very singular fan-shaped antennæ. On the back are light blotches. It is found in July. Dr. Harris mentions as feeding upon the elm, *Phyllophaga georgicana*, Gyll., and *Phyllophaga piliosicollis*, Knoch. Among the leaf-eating beetles none are more destructive than those called

THE ELM LEAF BEETLE.

This is a small beetle which has attracted considerable attention for some years. It is said to have been brought from Europe, on imported elms in 1837, but for a long time it did not receive much notice. Of late, however, the ravages committed by the beetle

have been so great that its habits have been carefully studied. In general form and size this beetle, *Galeruca xanthometæna*, Sch., resembles the common striped cucumber beetle. The wings are yellow, varying in shade from light to dark. On the head and thorax are black spots, and on the wing-covers black lines, a narrow one along the inner edge, and a wider along the outer. The under side is black, and the legs are yellow.

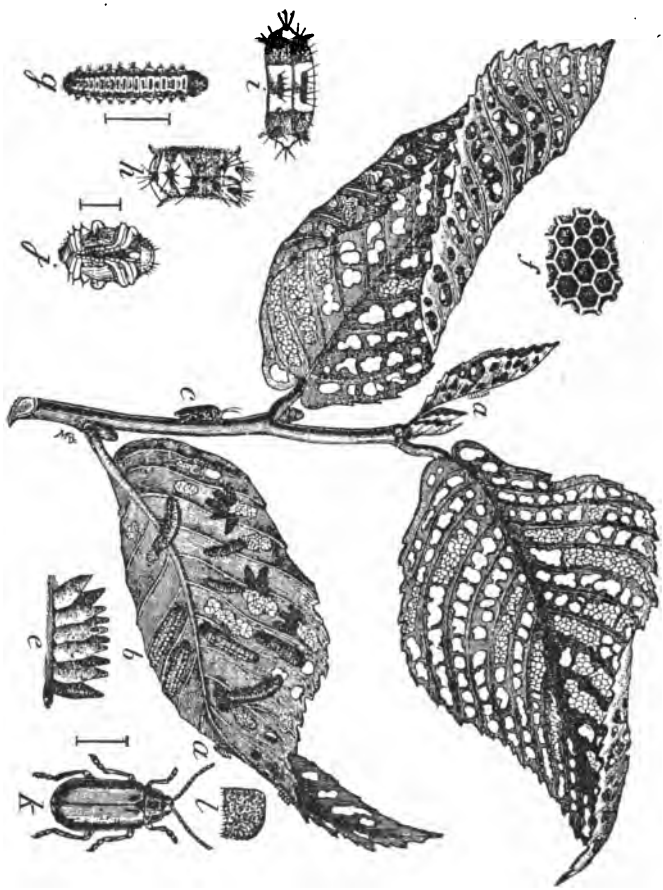


Figure 48.

ELM LEAF BEETLE.

Galeruca xanthomelæna, Sch.

a. cluster of eggs; *e.* eggs magnified; *f.* surface of eggs highly magnified; *b.* larva, natural size; *g.* larva enlarged; *h.* joint of larva, side; *i.* joint of larva, back; *c.* beetle, natural size; *k.* beetle enlarged; *j.* pupa.

The eggs, figure 48, *a*, are laid on the under side of the leaf, where, if all is favorable, they hatch in about a week into hairy, yellowish black larvæ, figure 48, *b*. *g*. This is in May, or early in June. The larvæ grow brighter in color, as they grow older. When fully grown they are about half an inch long, and of the form shown in the figure. As seen in the enlarged sections, shown at *h*. and *i*., the hairs are in tufts. Beside the yellow band along the back, there is a similar one along each side. The head is mostly black. After hatching, the larvæ at once begin to feed upon the leaves, eating out the pulp, leaving the woody framework as seen in figure 48. They continue feeding only about two weeks, but as the eggs do not all hatch at once, the trees may be infested by them at any time from May to August, although the length of the time during which they feed would vary with season and temperature. When fully grown the larvæ go to the ground and change to pupæ. According to Riley, the pupa stage lasts from six to ten days. This insect bids fair to become one of the most dangerous foes of the elm. Concerning its ravages in New York, Dr. Lintner remarks, Fourth Report of State Entomologist, 263: "During the last few years it has extended its ravages to Long Island and Westchester County, N. Y., where by its complete defoliation of large and beautiful elms, and by the myriads of the disgusting larvæ swarming on the trunks of the trees, it became a common object of observation and execration." It has been gradually working its way northward, and though not yet a pest in Vermont, it does occur here, and may easily become a serious pest. The beetle has been carefully studied at the Department of Agriculture, and figure 48 is taken from one drawn by Dr. Riley. The insect has sundry enemies among beetles, which keep it in check to a certain extent. Plowing the ground under infested trees when the larvæ are in the ground, thus exposing them to birds or swine, which should be done after the first of August, is to be recommended. Spraying the infested trees, has on the whole, proved most useful, and has, I believe, uniformly produced good results. The mixture which, after very numerous experiments by different persons in different parts of the country, seems best, is the following: Three-eighths pound London purple; three quarts flour; forty gallons of water.

The object of the flour is to render the liquid more adhesive so that it does not so readily wash off from the leaves and twigs. In

the United States Agricultural report for 1883, pp. 167-169 there is given a detailed account of the methods employed at Washington to destroy this beetle and the results obtained. These were, in briefest statement: "From midsummer until autumn the unpoisoned half (of a grove of elms) remained denuded of foliage while the poisoned half retained its verdure." As has been stated the beetle was imported with the European elm, but it has gradually extended its operations to the American elm. One of the most helpful accounts of operations against this beetle which I have come across was published by Prof. J. B. Smith, in *Garden and Forest*, June 19, 1889, and as the suggestions therein given apply almost or quite as well to any other leaf-eating insect and to any other tree, I quote several paragraphs. "The trees on Rutgers College Campus were effectually protected by spraying with a mixture of one pound of London purple in a hundred gallons of water. In this proportion the larvæ are destroyed and the foliage not injured." Six pounds of common wheat flour was added to the above mixture, and in order that it might adhere better to the downy underside of the leaves, one gallon of common kerosene emulsion was added. This mixture proved very satisfactory for all purposes. Concerning methods of applying the above Prof. Smith, says: "The results of an application of this mixture are quickly noticeable. The young larvæ succumb almost immediately, and many of the eggs are destroyed where they are fairly hit by the mixture. Another point to be observed is the time of application. This should be just after the eggs are hatched, and before the larvæ become half grown. One application will probably be sufficient, though the tree may be somewhat eaten by the imago. If the trees to be protected are small and few in number it will pay to spray twice, once when the beetles are beginning to deposit and again when the eggs are hatching. If sprayed too early a few beetles will be destroyed which will be replaced by later arrivals and little good is done. If sprayed too late the advanced larvæ will be ready for pupation and will not be affected. Many a man has tried poisons to destroy insect pests and declared them to be failures; they were not so because of any fault of the poison, but simply because they were put on at the wrong time and in the wrong way. It is advisable to avoid wetting the trees more than necessary. The finer the spray, and consequent coating of poisonous mixture, the better the results." The elms referred to by

Prof. Smith were large trees and the whole top could be reached only by means of special appliances. A force pump and wheeled tank were used; to the pump was attached a hose fifty feet long at the end of which was, of course, a nozzle. This was attached to a bamboo pole ten feet long and by this means trees could be sprayed from the ground to a height of twenty or thirty feet, and with a ladder all parts of the largest trees were reached. Of this Prof. Smith says: "Few shade trees are larger than those sprayed by me and no more apparatus would ever be required. For the largest trees, over fifty feet in height, I use about twenty gallons of water containing about one fifth of a pound of London purple and one pint of kerosene emulsion, at a cost of seven cents and the labor of applying the mixture. The result has been to destroy all the beetles and larvæ and most of the eggs, and has preserved fine looking green trees instead of skeletons with fragmentary patches of withered leaves." The importance of using the right means in dealing with insects is shown by an incident in the history of this beetle which happened some years ago in Baltimore. The elms of that city were being greatly damaged by some leaf-eating insect which was hastily supposed to be the canker worm, and the city authorities incurred a considerable and useless expense in protecting the trees against an insect which was not there, instead of first making sure of the insect, and then using proper means for its destruction. The insect in this case being the Elm Leaf Beetle, and not the canker worm, the remedy did little good.

A very pretty little beetle is

Chrysomela scalaris, L. Conte.

Like the foregoing, this is a leaf eater. The upper wings are silvery white, spotted with green, while the thin under wings are red. The under side of the body is dark green, as in the thorax and head, while the legs are brown. This beetle is about half an inch long. The eggs are laid in the spring, and again the latter part of the summer. The larvæ hatch soon after the eggs are laid and develop into short thick grubs not unlike the larvæ of the potato bug in shape, as indeed they may be, for the beetle is allied to that insect. These grubs are light above with a row of black dots along each side, and a black line along the back. Both beetles and larvæ feed upon the leaves and sometimes do considerable damage. The usual remedies would be sufficient. They feed upon the basswood, willow alder and elm. A small snout

beetle, *Magdalis armicollis*, Say. is said to infest the elm, but I do not know anything of its habits.

Another beetle known as the

RED SHOULDERED SINOXYLON,

though attacking fruit and other trees is also found upon the elm. This beetle is one of a large group of boring beetles. Its scientific name is *Sinoxylon basilare*, Say. It is black with a red spot on

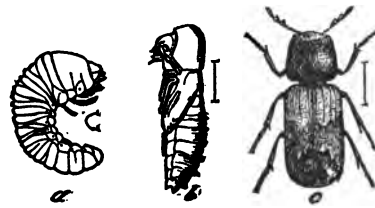


Figure 49.
Sinoxylon basilare, Say.
a. larva, *b*. pupa, *c*. beetle. All enlarged.

the anterior portion of each wing cover. The form of this insect and general appearance is shown in figure 49. The larva is white or yellow. It bores into the wood of the tree, which it infests, and if in any considerable numbers may do considerable harm.

Another boring beetle which confines its labors chiefly to the bark of the peach and other trees, is *Phlœotribus liminaris*, Harr. This is said to attack the elm, and has ever been called elm-bark beetle, but it appears doubtful if it ever attacks the elm. Another little boring beetle, *Hylesinus opaculus* L. C., very closely re-

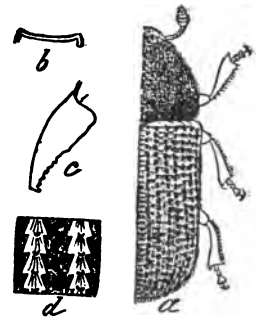


Figure 50.
Hylesinus opaculus, Le. Con.

sembling the preceding, is shown in figure 50, taken from Riley. The color is black, and the wing-covers are dotted with little pits. It bores in the bark of the elm and ash.

Dularius brevilineus, Sar.

This is one of the largest of the elm infesting insects. The perfect beetle, figure 50, is nearly an inch long, with large, stout legs. The wing-covers are relatively smaller than in most beetles, and do not cover the end of the abdomen. The color is dark blue. Its larva bores into dead wood, and cannot, therefore, be called injurious, unless it should be destructive to timber.

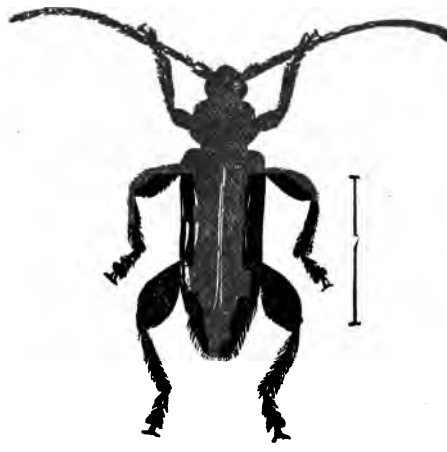


Figure 51.

Dularius brevilineus. Enlarged.

Of all the beetles the most mischievous to the elm, and one of its worst foes in this region, is the

ELM BORER.

This beetle, shown with its larva in figure 52, is somewhat like the common apple tree borer in its general form and appearance, though it is rather smaller, and differently marked. It may be recognized without difficulty by the peculiar dull red line which

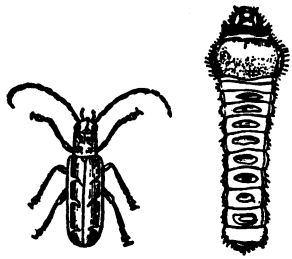


Figure 52.
ELM BORER.
Saperda tridentata, Oliv.

borders the outer edge of the wing-covers, and sends inward, as the figure shows, three curved, tooth-shaped projections. On account of these it might be called the three-toothed borer, if it were understood that the teeth were merely color-marks. Its scientific name is given it because of these three points of color, and is *Saperda tridentata*, Oliv. The general color is dark brown, and besides the red lines and points mentioned, there are other red markings on the thorax. There are also black dots on

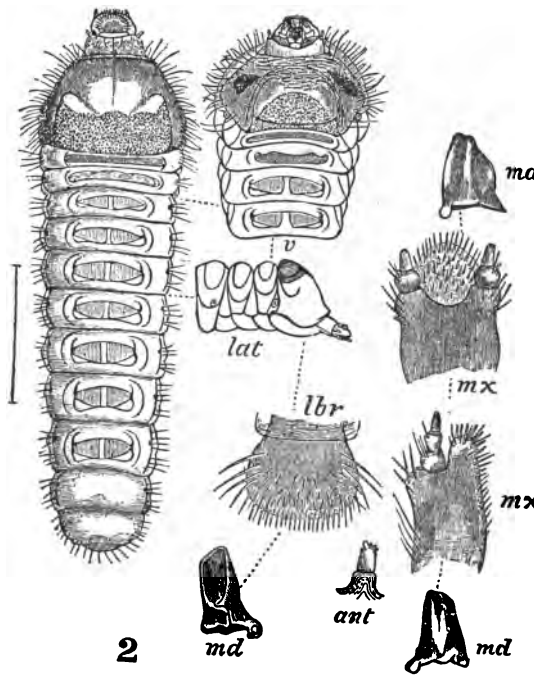


Figure 53.
LARVA OF ELM BORER.
Saperda tridentata, Oliv.

Much enlarged. *v.* under side of head, and five following joints; *lat.* side view of the same; *md.* jaws, or mandibles; *mx.* maxillæ; *ant.* antenna; *lbr.* labrum.

the thorax and wings. A fine grayish down covers the body, so it appears lighter than it otherwise would. As in most boring beetles, the antennæ, or feelers, are long and slender. It is not the beetle, however, but its larva that does the mischief. This is seen at the right of the beetle in figure 52, and an enlarged figure of the larvæ, both from Dr. Packard, in figure 53.

This latter figure gives a very excellent idea of the structure of this borer. The actual length of the worm is about three-fourths of an inch. As may be seen in the figures, its form is flattened cylindrical, the back being less convex than the sides. The beetles lay their eggs on the bark of the trees, and as these hatch the young larvæ bore inward, but they do not seem to ever penetrate as deeply as do the apple tree borers, or many others. They do much of their burrowing in the outer sap wood. During the summer they feed continually, but as cold weather approaches they become dormant, in which state they remain through the winter, again arousing themselves to activity as warm weather comes on. Thus they live, growing larger each season, until the spring of the third year, when they cease boring finally, and become beetles, which appear usually in June. It seems quite probable that all the larvæ do not wait until the third year, but are transformed the second spring. Trees infested by this beetle, which is only too common in Vermont, if there are many of the pest present, at once begin to show signs of trouble, and if the evil has gone on the bark becomes dry, and can be pulled off in large pieces, as it is separated from the underlying wood, and if unchecked, the attack in time not only weakens but destroys the tree. Early in the course of the beetles their presence can be recognized by the moist spots on the bark where the sap has oozed from the borings. If such places be taken at once in hand, and the bark cut into with a sharp chisel, the borers can be discovered, and removed with no great injury to the tree. If the bark is scraped and kept as smooth as possible, which in the elm, unfortunately, is not very smooth, and then washed over with kerosene or carbolic emulsion early in June, or perhaps the last of May would be as well, the female beetles would not be likely to deposit their eggs upon it. Cutting out the larvæ is a tedious process, but when they are once lodged in the wood it is about all that can be done, and a badly infested tree can only be treated successfuly as it is cut down and burned, so that the beetles may not spread from it to other trees. The downy and hairy

woodpeckers are undoubtedly of especial service in destroying these borers, and the tit-mice as they hop over the bark probably destroy their eggs. Another allied species, *Saperda lateralis*, Fabr., infests the elm, but as it confines its attention to dead trees, it does no harm.

Another beetle, *Neoclytus erythrocephalus*, Fabr., reported as boring elms in Michigan.

A leaf eating beetle which thus far has confined its devastations to the slippery elm is,

Monocesta coryli, Say.

Figure 54, after Riley, gives a very excellent representation of this insect in its various stages. The beetle is light yellow with "two dark bluish spots on each wing cover." These spots, however, are sometimes entirely lacking. The larvæ are of the form shown in figure 54 *d.*, and when fully grown are brown, but when first hatched they are yellow. In August or the last of July the larvæ go to the ground and form below the surface a cell, in which they pass the winter dormant. The following spring they change to pupæ, figure 54 *i.*, and in about a week they become perfect beetles, which appear in June. Spraying infested trees in June, or as soon as the eggs begin to hatch, would be efficient, and Dr. Riley says that as the larvæ are very sluggish they may be shaken from small trees.

There is a large larva which has attacked elms in this neighborhood, but I cannot say what it is as I have not been able thus far to capture it. My attention was first called to its ravages last fall and one of the larvæ, the only one apparently in the region, had been taken, but was destroyed before I returned from out of town. The description given by several who saw it would indicate the larva of some beetle like *Prionus*, and I am inclined to think that it was *Prionus brevicornis*, *Fabr.* of a closely allied species. Its method of attack, however, was different from any that I have seen, judging from its results. There were around the tree from which the larva that was secured was taken, furrows in the inner bark and outer wood, some of them two or three feet long, and callused over by the growth of the bark an inch or even two inches wide. Of course the original furrow was less than this, but the nearly fresh one which I saw was three quarters of an inch wide. Evidently the tree had long been the home of this

Figure 53.

Monocesta coryli.

a. Mass of eggs; *b*. egg magnified; *c*. larvæ feeding; *d*. adult larva; *e*. larva molting; *f*. outline of one joint; *g*. head of larva, enlarged; *i*. pupa; *j*. beetle.

species, for there are about it great callous ridges from near the ground to up on the larger branches.

ORTHOPTERA.

This group, although it contains many insects that are exceedingly destructive to crops, contains few that injure trees, and I know of only one that infests the elm, and this is nowhere, I think, very troublesome. This is the,

TREE CRICKET.

It is not a very common insect here, though perhaps more so further south. Figure 55 gives a view of the male of this species. *Œcanthus niveus*, *Serv.* It is more destructive to raspberries and grapevines. The males are white and the females sometimes white, sometimes dark. The insect is allied to the common cricket, and is able to produce very loud, shrill chirping. The female pierces with her ovipositor the canes of raspberry or wood of small branches, peach or grape or elm, and deposits her eggs in the peth. These punctures are in a row and may so weaken the twigs that they break off. The insect does not eat any part of the plants which it infests and the injury which it does is purely mechanical. They are also to be ranked with beneficial insects, for the larvæ feed upon plant lice and other small insects. Whether they on the whole do more harm than good I do not know.

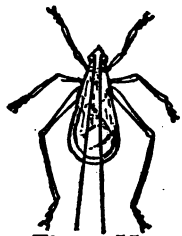


Figure 55.
Tree cricket.

HEMIPTERA.

To this group, which embraces some of the most simply organized insects and the lowest in rank, belong some very destructive species. All the insects of this group which we shall consider are small, most of them microscopic, and their life history is very complex and obscure. Those which infest the elm are such as are commonly known as plant lice. No group of insects contains so many species which are likely to be overlooked because of their minute size and because they hide in crevices of bark and similar locations, and this is the more unfortunate because, when once established, they multiply prodigiously and soon overrun a tree to such an extent that their removal involves much labor. The amount of injury which any single plant louse, or

aphis can inflict is quite trivial, but when this is multiplied by the large numbers which may exist, the evil reaches large proportions. Sometimes the aphides can be eradicated without great difficulty, sometimes they defy all efforts with any known insecticide. They all have a beak with which they puncture the plant upon which they have settled and having thus made an outlet for the sap they feed upon it. This drain upon the plant weakens it, and when the leaves are attacked they may swell, crumple or become covered with galls so that their natural function is hindered or prevented, and the plant suffers if it does not perish. The aphides are eminently plant parasites, and almost all species are infested by one or more species of aphis, which are often peculiar to it.

The "honey dew" found, it may be to a disagreeable extent, about plants infested with aphides, comes from the repletion of the insects. They suck up the sap of the plant on which they have located until they are full and more. In many species there are on the upper, hind parts of the abdomen two little tubes which serve as outlets for the sap, and this is distributed as a transparent, milky or colored liquid of a sweet, sticky nature, much liked by ants and some other insects. This "honey dew" is sometimes produced to an astonishing extent, considering the very small size of the insects which produce it. Last August it was literally showered down from some of the elms in Burlington, so that the fences, walks or whatever was beneath them were bespattered thickly with the sticky fluid which turning black as it was exposed to the sun and air and became exceedingly unpleasant. As will be shown later the metamorphoses of the aphides and their allies are much more numerous than is usual, even among insects, and the differences are sometimes so great that it is difficult to recognize the same insect under its varied disguises. Not only are there different broods, each different from the others, but within the limits of each brood the changes from the egg to the adult are often great. So, too, in their reproduction they vary. One brood lays eggs, which perhaps develop into forms unlike the parent, all of which produce living young, there being no sexual distinctions, and in course of time from these, or their descendants, come true males and females which pair and again hermaphrodite forms appear for a series of generations, and so on. Fortunately for man the aphides are weak and slow moving insects, and are easily seized by their numerous enemies.

The common laced-winged fly, an insect often coming into our houses on warm evenings, shown with its eggs in figure 56, is a

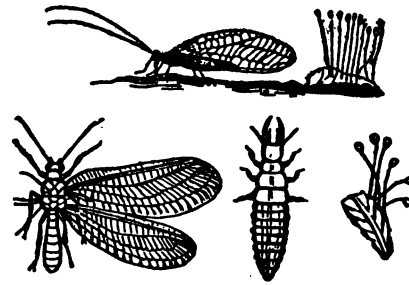


Figure 56
Lace-wing flies, eggs and larvæ.

very useful insect as it feeds on plant lice. The insect is a very pretty, gauzy-winged creature of a delicate green shade, but its attractions disappear if the contact with it is too close, for it produces a most disagreeable odor. Dr. Packard says, that this insect, *Chrysopa*, is so much esteemed as a destroyer of plant lice, that European gardeners "search for these aphis lions and place them on fruit trees overrun with lice, which they soon depopulate." There are a number of species of "lady-birds" or "rose-bugs," small reddish globular beetles with black spots and markings, though some are differently marked. Figure 57 gives several dif-

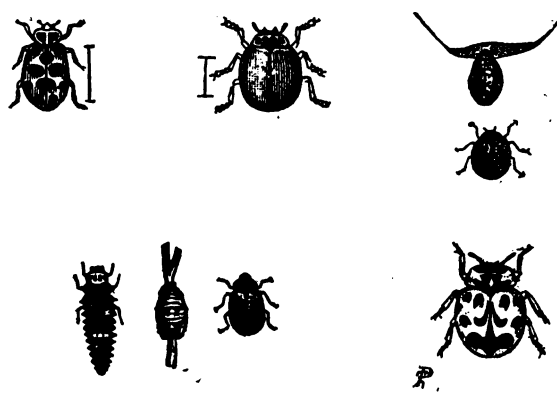


Figure 57

ferent species of the lady-birds and shows differences in the markings as well as in form. The first figure beginning on the left in figure 57 is *Hippodamia maculata*, De. G. a common species. The next without spots is *Coccinella munda*, Say. and the next *Coccinella novemnotata*, Herb., above which is its pupa. Below, on the left, is shown a form common south of here in three stages. Another figure of the same species is shown in figure 58 number 14, natural size and enlarged. Figure 58, copied from a plate by Prof. Comstock, gives excellent illustrations of several species of these lady-birds both natural size and enlarged, and the larvæ of most of them, enlarged. A brief enumeration of the species illustrated may be of service to some. As I think it very important that all should be familiar with these insects, I have introduced numerous illustrations and have thought best to give figure 58 entire, as Prof. Comstock gave it, though all of the species figured are not found in Vermont. Numbers 1, 2, 3, *Cycloneda abdominalis*, Say., larva, pupa, and perfect beetle, "is a small ashy gray insect, there are seven black spots on the thorax and eight upon each wing cover." Comstock. *Cycloneda sanguinea*, L. is shown in the larva and perfect stage in 4 and 5. "Its color varies from blood-red to brick-red, thorax black with two orange spots and edged with the same color, and head black with two light spots." This is the same species as that shown in figure 56, upper middle figure, named *Coccinella munda*, Say., but referred by Prof. Comstock to Linneus' species. It is common everywhere. Number six is, *Cycloneda occulata* a species which closely resembles a more common one known as the twice-stabbed lady-bird, *Chilocorus bivulnerus*, Mul., as does also number 9 which is a west coast species, shown in its three stages. It lives on cactus. The twice-stabbed lady-bird is especially useful in destroying bark lice. Numbers 10, 11, 12 illustrate a very common and very useful lady-bird, *Hippodamia ambigua*, Lec. The larva of this number 10 is a slug-like insect of a blackish color above, and greenish below. The upper part is spotted with orange. The perfect insect, number 12, is black with a partial white border on the thorax, while the wing-covers are red. As the figure shows, this species is longer than many lady-birds. Number 13 is a western species. Number 14, as has been noticed above, is *Hippodamia convergens*, Guer. This is one of the most common species, especially in the south. The only beetles which

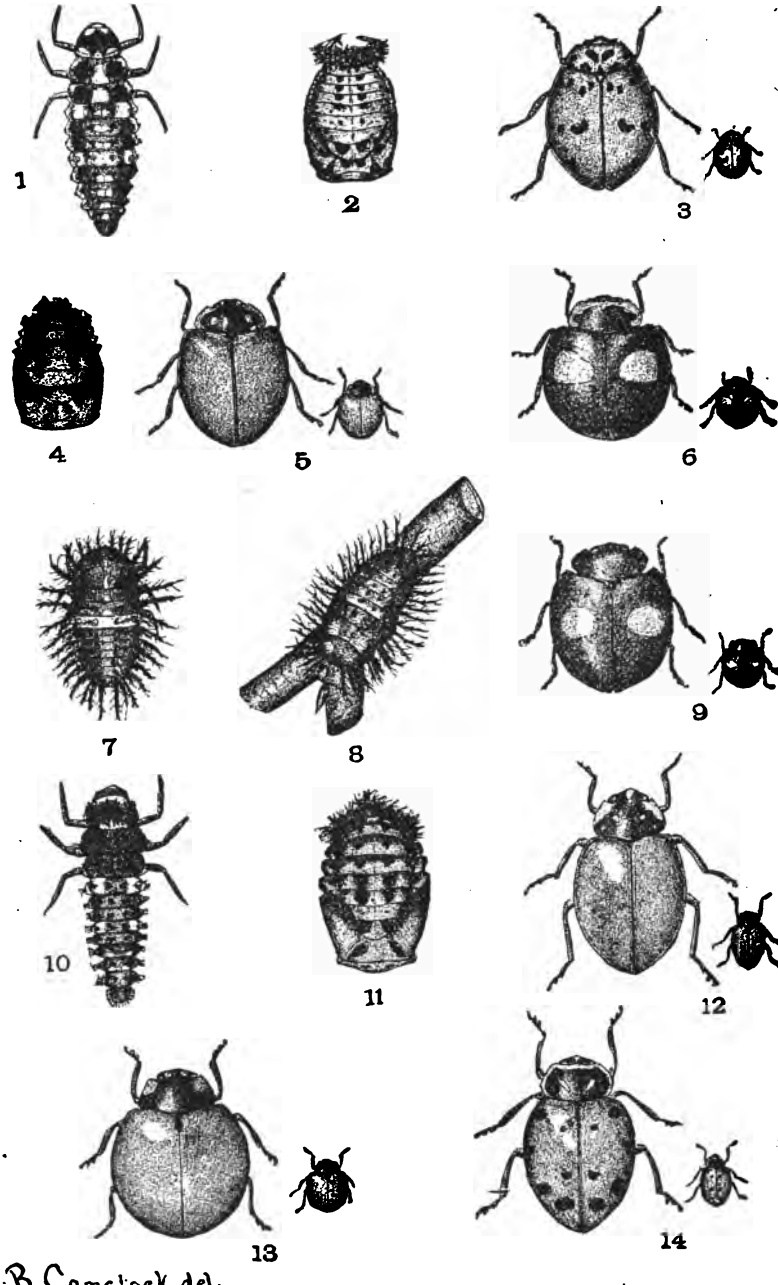


Figure 58.

I now recall that are at all likely to be mistaken for the useful lady-birds are shown in figure 59. The left hand beetle is one of

Figure 59.
Epilachna borealis. Th. *Diabrotica 12-punctata*, Fab.

the lady birds, but it does not, as all the rest, feed upon insects, being a vegetable feeder. Its name is *Epilachna borealis*, Th. It is, so far as I know, the only one of the many lady-birds which feeds upon vegetables. It is larger than the other species given, of a reddish yellow color with seven black spots on each wing-cover. The head and thorax are colored like the wing-covers. It feeds upon nearly the same plants as do the common striped cucumber beetles. Another beetle resembling rather closely the lady-birds is *Diabrotica 12-punctata*, Fab., which eats cucumber, squash and other leaves. This is shown at the right in figure 59. A group of flies known as Syrphus flies, one of which with its larva, both enlarged, is shown in figure 60, are useful in destroying plant

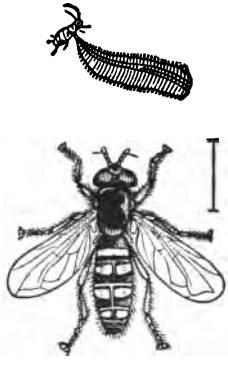


Figure 60.
Syrphus fly.

lice and many of the carnivorous insects find acceptable food in these soft bodied insects.

Among birds, perhaps the tit-mice are as serviceable as any in destroying the plant lice. Insecticides of various sorts have proved more or less useful preventives of the ravages of plant lice. Pyrethrum, especially if used mixed with water, is often very good. Potato parings boiled in water produce a liquid which appears to be fatal to many insects. The kerosene or carbolic acid emulsions mentioned in the early pages of this article are very useful against many of the plant lice. Some years ago a solution was recommended by the United States Agricultural Department which is made as follows:—

2 ounces Sulphur flour
2 " Washing soda
½ " tobacco

A piece of quicklime the size of a duck's egg. Pour all the ingredients into a pot or pan, boil for fifteen minutes stirring constantly. After this let the mixture stand quietly until it settles, when the clear upper portion can be poured off from the sediment. The portion poured off will keep indefinitely. In using it needs to be diluted considerably, more or less as the foliage is tough or tender.

The plant lice are grouped by entomologists in four subdivisions, or families. The first family includes the familiar scale insects, bark lice, mealy bug, etc., and is called coccidæ. It is a group not easily defined because it includes many varied forms. In many cases there is a remarkable diversity between the males and females and sometimes they are to all appearance about as unlike as possible, certainly they are more unlike than many insects placed in widely different zoological groups. This family includes a large number of exceedingly troublesome insects, and no insects are more readily carried from place to place since in some of their stages of growth they are able to withstand great changes in the surrounding conditions. Moreover some are protected by a scale which completely covers them, others secrete a downy or wooly covering which wholly changes their appearance and also affords some degree of protection. Certain products of commercial value as cochineal, and shellac are obtained from species of coccidæ and quite a number secrete wax sometimes in sufficient quantities to be of value. As a rule the perfect males are active, two-winged insects, while the females are sluggish and wingless. To this group

belongs the oyster shell back louse of the apple and other trees which has long been known as *Aspidiotus conchiformis*, but Dr. Riley has removed it from this species and redescribed it as *Mytillaspis pomicorticis*, Riley, while he retains the old specific name for the bark louse of the elm which thus remains *Mytilaspis conchiformis*, Gmel. It however, certainly resembles very closely the apple scale both in habits and appearance.

THE ELM BARK LOUSE

has long been known in Europe, and was doubtless brought to this country on imported elms, and has not, at least so far as I know, increased to such an extent as to be seriously injurious to the American elm, on which, however, it sometimes occurs in considerable numbers. In this species both males and females are covered by a scale soon after they are hatched, though the females far outnumber the males. The female scales are familiar to all, and in this species the male scales are not very different. If in the winter or early spring the scales are examined, they will often be found to cover what appears like a yellow or reddish dust, but which is really a mass of eggs. These eggs hatch in the spring or early summer, into minute, active larvæ, which soon leave the protecting scale and run over the tree. At this time their form is oval, and they may be not more than $\frac{1}{100}$ inch long, so that they are only just discernible by the unaided eye. They have the usual beak of this class of insects, and this they thrust into the bark, and begin to pump up the sap. The insect is soon attached by its beak, and after this does not move about. Ere long, delicate white threads are produced, and later, a continuous covering which becomes the scale. The form changes, and the insect is soon very different from what it was when first hatched, and on the whole, it appears to be less highly organized, if the insect be a female. After the impregnation the eggs develop in the body in great number, and these, when mature, are deposited under the scale. The male develops differently, and is, apparently at least, more highly organized than the female. He is furnished during a part of his life with a gauzy, transparent pair of wings, the hind wings being developed only into little hooks. After laying the eggs the female perishes, and during the winter only eggs are found in the scale. The perfect males have no proboscis or mouth parts, as the female has, but by a most singular transformation the mouth parts are

replaced by a pair of eye-like bodies, which probably serve as a secondary pair of eyes. Prevention is eminently better than cure, in case of scale insects. If they are only detected when they first appear, they can be readily removed by a blunt-edged knife or stick. If too late for this, washing the twigs with strong lye water, kerosene emulsion, or some such substance, is beneficial. Very likely other species of scale will be found on the elm as the group is more carefully studied. A new insect not known in this country until within a few years, is allied to the scale insect, though instead of a scale it protects itself by a cushion of cottony fibres. This may properly be called, though the name is not very distinctive,

IMPORTED ELM LEAF APHIS.

This was first described in this country by Mr. L O. Howard, Assistant Entomologist United States Agricultural Department, and to him I am indebted for the accompanying figures. It was first discovered in 1884, in Westchester County, N. Y., and from there specimens were sent to Washington, and afterward other specimens from other localities. Mr. Howard, far more completely than any one else, has worked out the life history of this insect, and to his account published in *Insect Life*, vol. 2, p. 34, we are much indebted. The insect has been gradually extending, and now has quite a wide range over the country. How long it has been in Vermont I do not know. I first found it in Burlington in 1889. Whether our specimens have come from other infested American elms originally, or from European elms, which have been planted here, of which there are a few, I cannot tell, but it is here at any rate, and its history is of sufficient interest to demand some attention. It is reported as abundant near Boston. Its fond habit seems to vary somewhat, for we are told that in Cambridge, Mass., it is found upon the slippery elm; in Washington it occurs upon the European and several other species. Here it occurs on the common American elm, and I have followed it for some time in its development upon this tree. During the late fall and winter we find it dormant in the crevices of the bark. Specimens which I examined in November, or in some cases earlier, and others collected in January and March, were precisely alike, having the form and appearance of those shown in figure 61.

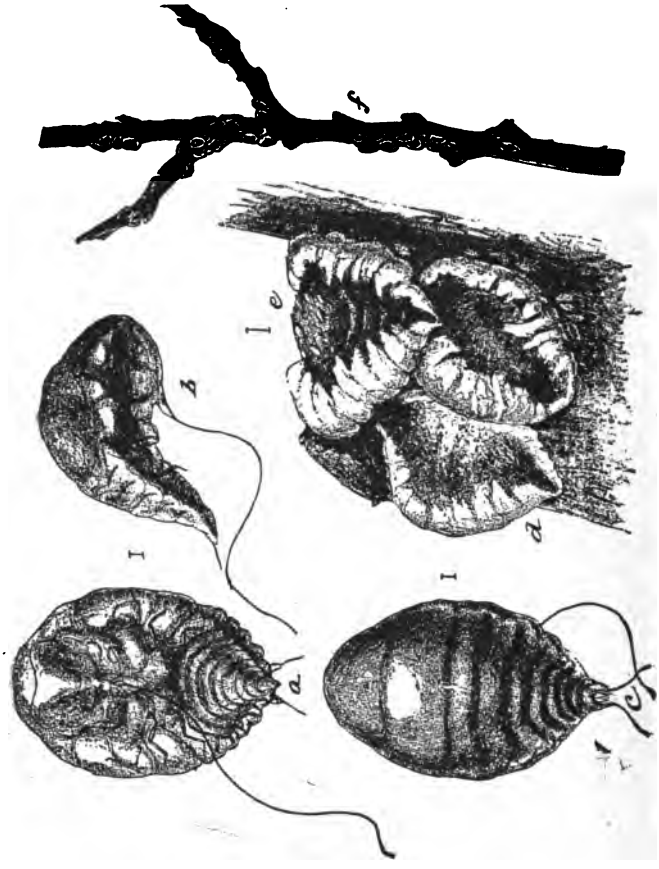


Figure 61.

Gossyparia ulmi, Geoff.

a. b. c., appearance of the insect as it is dormant during the winter; *e.* cushions, or scales on the bark upon which the insects rest; *f.* twig, with insects on the bark.

At this time those which I have seen are of a light, yellow color, and have a sort of resinous appearance,—that is they seem as if made of gum copal or amber. They are usually, to all appearance, lifeless, although when kept for some time in a warm room, they curl as shown in the figure at *b*. It is hardly necessary to notice that the figures are all greatly magnified, the lines by the side of each figure being intended to indicate the actual length.

In the spring as the warm weather comes on the dormant lice awaken to activity and as Mr. Howard informs us the females then

throw off the old skin and the males form a cocoon of waxy filaments which they secrete. This cocoon is an oblong cylindrical affair, six or seven hundreths of an inch long, in which the insect remains for some time. There seems to be two sorts of males, one of which figure 62, comes from the cocoon earlier than the other form. As the figure shows, it has very slightly developed wings, so small that they can be of no use to the insect. This form seems to be sexually perfect; although this point is not certainly established. They certainly pair with the females, and probably impregnate them. The body of these males are about six hundreths of an inch long and fifteen thousanths of an inch broad. The true males figure 63, middle figure, are furnished with a pair of large wings by which they fly readily. As has been indicated above, they are longer in the process of pupation than the less fully winged males coming from the cocoons some days later than they do. The different form of the body, its more slender shape, and especially the two long filaments extending from the abdomen of the perfect males will be readily seen in the figure. It does not appear clear whether the two classes of males develop from different sorts of eggs or whether the perfect males are those in which additional development and moulting has occurred. Mr. Howard evidently thinks the latter to be the true explanation of the case. Judging from my own observations I think it probable that some differences in the food, season, climate, etc., affect the development of the insects and that under some conditions imperfect males predominate, while under others the perfect ones are more abundant. In Europe it would appear that either the perfect males are very scarce or have been overlooked by entomologists, if we may judge from their writings.

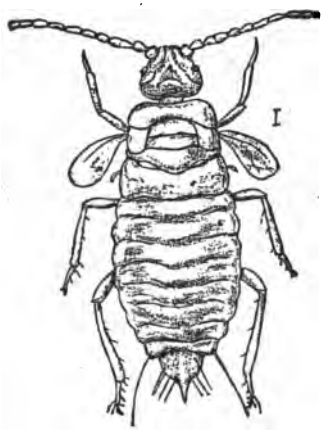


Figure 62.
Gossyparia ulmi.
Imperfect male.

As figure 63 *a*. shows, the female before pairing is very unlike the other forms, and her own changes greatly after impregnation. She is at first a spiny oval, wingless insect the segments of the

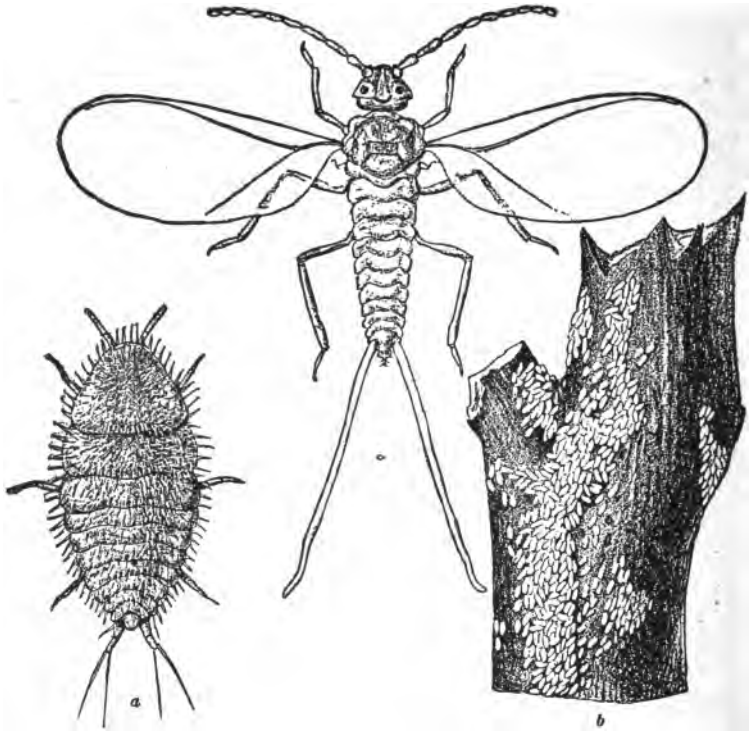


Figure 63.

Gossyparia ulmi.

a. Female before impregnation; *b.* bark covered with male cocoons; *c.* perfect male.

body being very clearly marked. Each joint is provided with glands, which secrete a waxy substance. After pairing, the body becomes more rounded, the waxy secretion increases, the insect remains attached to a given spot, and a thick, scaly cushion is formed, the spines disappear and the surface of the body is smooth and shining. At this stage honey dew is formed in very considerable quantities from the excess of sap which the insect takes from the tree. This is showered down upon whatever may be below the branches on which the insects have located. After a short time the young are produced alive, in June or July.

After the young appear the female loosens her hold upon the twigs or bark. The young are as unlike either parents as these are unlike each other, though they resemble the female rather than

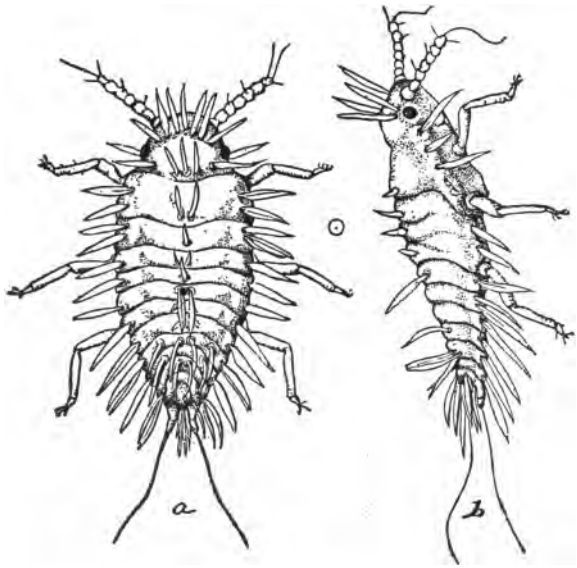


Figure 64.
Larva of Gossyparia ulmi.

the male. Figure 64, gives an enlarged view of the larva seen from above and from the side. These larvæ are, as might be expected, exceedingly minute objects. They are quite active and run about the tree looking like grains of fine yellow powder. After running over the branches for a short time, this in July here, they settle themselves on the under side of the leaves on young twigs or about buds. According to Mr. Howard, in species like slippery elm, in which the twigs are hairy or pubescent, they settle on the leaves, while in the smoother species they settle on bark or twigs. In August the young lice leave their summer feeding ground and go to the large branches or trunk, in the irregularities of which they find hiding places. At this time they produce again quantities of honey dew. Last August this was very abundant beneath some large elms in Burlington. According to Mr. Jack, of the Arnold Arboretum, this honey dew gives out a pungent odor which can be perceived at some little distance, but I have never been able to discover it. As cold weather approaches, the dormant stage with which we commenced is again reached and the insects are in the condition shown in figure 61. This insect has been found on the

American elm, two species of European elm, the slippery elm and the cork elm, *Ulmus racemosa.*

In regard to the presence and spread of the insect under consideration Mr. Howard says:

"The finding of *Gossyparia ulmi* upon American elms and upon European elms in this country was quite to be expected, and the only wonder is that it has not been found and recognized before. The species of Coccidæ have already extremely wide ranges, and every season still further extends them. Of our admitted North American Coccid fauna twenty-three species are of European origin (one more doubtfully so), three are from Australia and New Zealand, while sixty-nine are either truly North American or their original home is unknown. As several of these are found only on hot-house plants, they are certainly not North American. Several others are found on both native and imported plants and there are no data upon which to decide upon their proper faunal position. The fact that the *Gossyparia* prefers American elms at Cambridge is by no means without precedent in the group, and as another instance it may be mentioned that the beautiful oak-scale *Asterodiaspis quercicola* (Bouche), recognized by Comstock in 1880 upon foreign oaks on the Department of Agriculture grounds, is at the present time to be found almost solely upon American oaks in the same grove." *Insect Life* vol. 11 p. 41.

In considering remedies, perhaps not very much need be added to what has already been given among general insecticides. In the spring and early summer, kerosene emulsion or carbolic acid emulsion sprayed over the trees would prove a check. Mr. Jack says that as Amold abortum whale oil soap and kerosene were used successfully on the trunk and larger limbs and twigs. The lady-birds already fully noticed should not be overlooked in this connection. On the same trees which were infested with *Gassyparia* I found at different times during the winter, groups of lady-birds also hibernating in the same crevices and doubtless the beetles were awake as early in the spring as were the lice ready to feed upon them and to lay eggs among them which should soon hatch into larva that would be veritable lions and tigers to the young lice. The species most common was *Adalia bipunctata* the two spotted lady-bird and I have no doubt that these beetles are most serviceable in keeping the plant lice in check. In Cali-

fornia where the orange scale has been very troublesome, the imported Australian lady-bird has been found very useful so that the State Board of Horticulture raised the beetle for distribution among orange growers, that by its aid the scale might be checked. How valuable an aid this is, I do not know, as reports have not yet come in very extensively.

The second family of plant lice is called in the books the *Aleyrodidæ*. Less appears to be known concerning this family than of the others. They are winged in both sexes. The color is usually light, white or whitish, or yellow, and the distinguishing character is found in the light powder which covers the bodies of the adult insect. In the immature state they are covered with a scale. I do do not know that any species of this family is found on the elm.

The third family are the *Aphididæ*. These are the well-known plant lice which are more familiar to most than others of the group. The common green fly of the gardeners may be taken as a type of this family. A considerable number of injurious insects belong to this group. In his excellent Synopsis of the *A*phididæ of Minnesota, Mr. Oestlund has enumerated five species of *Aphides* which are found upon the American elm, and one which is confined to the slippery elm. It is more than likely, however, that when the group has been more thoroughly studied, this number will be increased. The family embraces a very large number of species infesting a great variety of plants. All are very small; most are soft-bodied, delicate insects, with four very thin transparent wings, or in many stages without wings. Like the *Coccidæ* these insects secrete honey dew at certain times in considerable quantities, and all are familiar with the fondness which ants manifest for this sweet substance. Other insects also feed upon it, but ants more than others. The changes which the *Aphides* undergo as they pass from brood to brood, will be better understood by the illustrations which follow, than by any general description. As will be seen, their modes of multiplicaton are peculiar. Many of them so affect the parts of plants which they infest that galls, swellings, crinklings, and other deformities are produced. The first species of this group to be considered is

THE ELM LEAF CRUMPLER.

This insect, *Schizoneura americana*, Riley, is of much interest,

both economically and scientifically. It has been made the object of very careful and thorough study by Dr. Riley, and to his paper we are indebted for the cuts which illustrate the species, as well as for many facts. This insect attacks chiefly the under side of elm leaves, and by its punctures causes them to swell and crumple, as shown in figure 65.

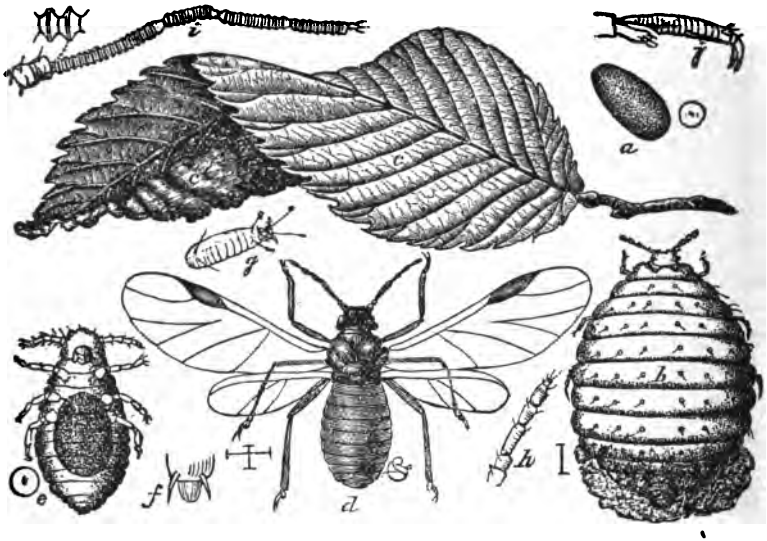


Figure 65.

Schizoneura americana, Riley.

ELM GALL LOUSE.

a. egg, as found in the winter; *b.* female in the spring; *c.* leaf curled, and with galls; *d.* winged female; *e.* wingless female; *g.* tarsus of *e.*; *h.* antenna of fourth generation; *j.* tarsus of *d.*; *i.* antenna of *d.*

The leaves are often very much more crumpled and rolled up than that shown in the figure. Indeed, I have found this species on young leaves, which they had so affected that they were almost globular. The eggs are minute yellow bodies, figure 65, *a.*, which deposited in the crevices of the bark are often covered and partially protected by the dried skin of the mother. The eggs are about two hundredths of an inch long. In the spring when the buds begin to swell and open, these eggs hatch, and the young larvæ at once make their way to the ends of the twigs and attach themselves by their beaks to the young leaves on the under side,

and the irritation caused by them affects the leaves as we have seen. There is no regularity about the curling; different leaves curl differently, and those which I have seen here, as has been noticed, curl more than is shown in figure 65. The curled leaf affords shelter to the *aphides*, and on opening it multitudes of them may be found hidden within its folds, little grayish or blackish bodies. When first hatched the larvæ are light colored, but as they grow older they grow darker; the legs are always darker than the body. According to Dr. Riley, the individuals of this first generation complete their growth in about twelve days, though the time varies with the season, for if cold days come the insects are dormant for a time, and then development is retarded. There are probably, Dr. Riley thinks, three molts. These, when mature, are the "stem mothers," figure 65, *b.*, and they live in the galls which they have produced, and commence filling the galls with young, which are alive when produced, and come at the rate of "one every six or seven hours, according to temperature, increasing in bulk and prolificacy from day to day, until by the early part of May in the latitude of St. Louis, she has attained her fullest development, and soon perishes. Riley, Bullet. United States Geological Survey, Hayden, v, p. 5.

The young of the second generation, those which come from the offspring of the winter eggs, the "stem mothers" of Riley, are very much like the parent, except that they never attain to so large a size, and are rather different in color, being of a reddish brown, or liver color. From these the third generation comes, and the individuals of this generation differ considerably from the preceding. These latter are wingless, and are of the general form shown in figure 65, *b.*, while the third generation are like *d.* of the same figure, and, as the figure shows, almost all the proportions are changed. The wings do not appear at first, but are developed as the insect becomes mature. Of these early generations Riley says: "During most of the month of May we may find, where large clusters of leaves are affected, the few more or less exhausted stem-mothers, and these second and third generations in every stage of development. As the lice increase in number the leaves no longer protect them, but present on both sides multitudes of busy atoms, livid old, and paler young, those with wings and those getting wings, interspersed with white exuviæ, cottony secretion, and globules of pearly liquid. At the

same time in single curls of more terminal leaves, we may find the second generation of wingless mothers, surrounded by smaller colonies, all of which will become winged." These winged females of the third generation do not appear to be long-lived, but during their life they produce what may be regarded as living young in great number. I say, what may be so regarded, for although deposited as eggs, and having the appearance of eggs, yet they hatch into living young almost immediately after they come from the parent insect. The larvæ of this fourth generation seem to be more brisk and active in their movements than any that precede them, and may be seen creeping over the twigs. At first they are reddish in color, but like all the broods they grow darker and browner with age. Like the second generation they have no wings, and like them they attack the leaves, increasing the deformity begun earlier in the season. Nor do they invariably attack the leaves, but appear to thrive on the younger bark, where sometimes they may be found, of course with no sheltering cover such as the gall affords those on the leaves. They are, however, more or less covered by a cottony substance which they secrete, although this in no way takes the place of the gall, since it is far more delicate, and is easily rubbed off. Reproduction goes forward rapidly, and they extend themselves over the twigs with corresponding rapidity. A phenomenon noticed by Riley, has not come under my notice, but it is extremely interesting. He says: "At this season of the year, when the lice are thus numerous, they may be found during the heat of the day actively crawling over all portions of the tree—a veritable migration necessitated by the want of sufficient succulent leaves, but destined to be the death of the individuals participating in it, excessive multiplication here, as in all other cases, obliging the destruction of the excess." From the fourth generation comes a fifth, which does not differ much from it. This fifth generation gives rise to a second winged brood like the third. This stage in the life of the species is reached in July, or sometimes about the last week in June. I have found them the 26th. They collect in crevices of the bark more than on the leaves or twigs, and in these places the seventh and last generation is produced. These for the first time show clearly sexual distinctions, reproduction up to this time having been asexual. They are dark yellow, or orange, and remain upon or in the crevices of the bark. The mouth is less perfectly devel-

oped than in former generations, and the eyes are simpler. The general form of a female of this generation is seen at *e.*, figure 65. After a short time the bright yellow, which at first characterizes the insect, becomes paler, the skin meanwhile being cast off, and though at first smooth and glossy, the surface of the body becomes dusty or powdery. The females, which are larger than the males, are about fifteen hundredths of an inch long. As may be seen in figure 65, *e.* the female as she grows has a single egg, developed within the abdomen; its ontlines can be indistinctly made out. Soon after pairing both sexes perish, leaving in the crevices or under scales of the bark the eggs more or less covered by the dried and shriveled skin of the parent, and thus they remain through the winter to develop in the spring into new "stem-mothers."

Schizoneura ulmi, Linn.

Is a very similar species, and infests European elms. This species has undoubtedly been confounded with the preceding, but it differs in some important respects, such as that the stem-mother of the last named species settles on the upper instead of the under side of the leaf. The galls are different, the wings seem to be longer, and the veining is somewhat different. Still the two species certainly approach each other very closely.

Schizoneura Rileyi, Thomas.

Is a species common in some sections of the country, and noticeably different from the other species that attack the elm, and in the character of the injury which it inflicts. It is described under the name of *Eriosoma ulmi*, by Dr. Riley in his First Report on Insects of Missouri; but Dr. Thomas in his monograph of the family, in Vol. 16, Transactions Department of Agriculture, Illinois, states that Riley's name is preoccupied by one of Linneus. The winged form is dark blue, about a tenth of an inch long, with long transparent wings. The younger, wingless forms are lighter, and sometimes are of a reddish shade. From the cottony or wooly substance which these insects secrete Riley calls the species THE WOOLY ELM TREE LOUSE. They collect on the tree twigs, branches, or trunk in clusters, and by the visitation of their punctures, produce a gnarled growth. The wool secreted is of the clearest white, and wholly covers the body of the insect, and when many are located on a branch they

give it the appearance of being covered with cotton wool. This makes them more conspicuous than most insects of this group. They cause great damage to the trees at times. Kerosene or other emulsions washed over the tree would be useful. Dr. Riley says, "I have experimentally found that a washing with a weak solution of cresylic acid soap will kill them instantly." Lace winged flies and doubtless other insects eat them freely. Another species which is quite common is one which produces very conspicuous and easily recognized galls on the upper side of the leaves; this is the

COCKSCOMB GALL LOUSE.

Colopha ulmicola, Fitch.

The general condition of leaves infested by this insect is shown in figure 66 *a*. though, of course, there may be more or less of

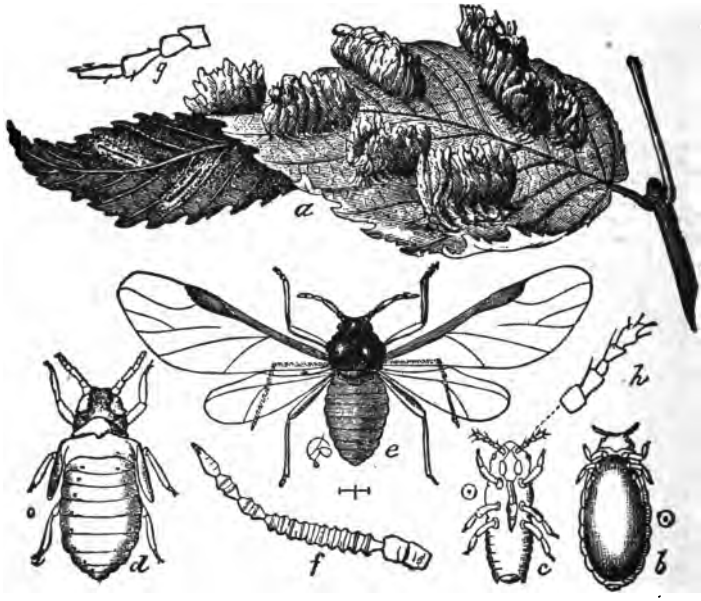


Figure 66.

COCKSCOMB GALL LOUSE.

Colopha ulmicola.

a. Leaf with galls; *b*. egg with dried skin of parent; *c*. young louse; *d*. pupa of *c*.; *e*. perfect, winged insect of *c*.; *f*. antenna of *e*.; *g*. antenna of first brood; *h*. antenna of *c*. All enlarged.

them than on the special leaf figured. They grow with astonishing rapidity, so that one day they are scarcely noticeable, while in a few days they are large. They are usually more or less colored red or brown, and I think the insects, as do most of the plant lice, prefer young trees to old ones. This species was first studied and described by Dr. Fitch in his Fifth Report, as New York Entomologist, but Dr. Fitch's account is by no means complete and has since been supplemented notably by Dr. Riley, whose figure is reproduced in 66. The egg, figure 66 *b.*, is placed in the crevices of the bark, and like that of the Schizoneura, is more or less protected by the dry skin of the insect which produces it. It is a very minute, smooth, yellowish brown body, and remains through the winter, hatching in the spring into a "stem mother," a dark greenish, or olive object which creeps over the twig until it reaches the twigs where the unfolding leaves attract it. To the lower side of these leaves the little insects attach themselves, thrusting their beaks into the soft pulp, and a gall soon begins to form. On the under side of the leaf the opening is a mere line or slit, hardly as conspicuous in many cases as in the figure, but the swelling of the upper surface is very obvious, being half an inch or more high and twice as long. At first the galls are mere linear elevations, the cockscomb-like form does not appear till later. In the early stages of the growth of the gall the originator of the summer's brood, the louse which hatches from the winter egg inhabits it as a domicile, but ere long, as the gall changes the occupant also changes, molting, growing lighter in color, and secreting finally a whitish chaff. As the gall reaches its full size the insect produces young, and this continues until the gall is full and sometimes crowded, and on pulling apart the sides of the slit on the under side of the leaf, they may be seen, little mouse colored or light gray objects of the form of *c.* figure 66. This is about the last of June in this region. Honey dew is produced at this time, though in less abundance than by some other species. In time the lice become of the form shown at *d.* and finally, when fully mature like, *c.* figure 66. In the young of this generation the color is light greenish or yellowish green, but by the time the winged state is reached the color has become dark olive. Until the winged, perfect stage is reached the gall is the sole habitation of the insects, but when thus mature they leave it, and so far as is yet known, all of this generation are females and produce eggs. The galls here are mostly empty

about the second week in July, though some of them will be found full later than this and the insects do not all leave the galls at the same time, for I have at the same time found galls in which a few winged insects remained, others in which there were more and others that were emptied. After the galls have been at least partially empty the insects may be found on the twigs and at the ends of the branches, though how permanently they locate there I do not know. There is a gap yet to be filled in the history of the insect between the third generation and the mouthless sexual individuals, the females of which so often perish while containing the single winter eggs. Respecting this, Dr. Riley remarks, "I have not been able to prove absolutely that there are two broods of the gall-making female, and my observations all tend to the conclusion that no galls are formed, except by the stem-mother that hatches from the impregnated egg. I have never succeeded in obtaining galls either by inclosing the winged females in muslin bags tied on the living trees or by similarly enclosing her immediate progeny, though I have succeeded in obtaining without any difficulty an abundance of galls by so inclosing the stem-mother. Moreover, all such succulent galls as this one are produced on the tender leaves only, and I have failed to find them on any but those which develop early in the season. It is true that we find the galls quite fresh, and containing larvæ, pupæ, and winged insects as late as the first week in July, and these late galls, as well as the insects within them, are generally more yellowish than those found earlier in the year; but a careful study of the structure of the inmates shows them to be identical with those found in the earlier galls; and these late galls are from present knowledge to be attributed to the work of late hatching and late developing stem-mothers, rather than to the work of the third generation. I am inclined to think that this third generation will be found to have a different habit; possibly feeding upon some other part of the tree without forming galls, and producing in time the true sexual individuals, something as in the case of *Schizoneura americana*." Bulletin U. S. Geol. Survey, Hayden, v, p. 12. While I would not assume to present observations upon this species which should be of the same value as those of so exceptionally skilful an investigator as Dr. Riley, I may yet add that my own investigations of this species confirm the opinions expressed in the paragraph quoted, and I do not at all believe that galls are produced by any

other than the stem-mother, for I have not been able to get any evidence that they are so and very much that they are not. I am also sure that, as has already been noticed, the insects after leaving the galls go to the extremities of the branches. However, whatever steps there may be which are yet unknown, there are at last produced wingless females, in which develops a large single egg, as has been seen.

Another species of aphis, which I have not yet found in this region, is described by Dr. Thomas, as a new species under the name *Callipterus ulmicola*, Thomas. It may be confined to the West, but it is very probable that it occurs wherever the elm grows. It is described as "an exceedingly delicate species" of a pale yellow color. Perhaps the character most distinguishing this species from others is found in the wingless form, in which "along the lateral margins of the abdomen, in front and behind the honey-tubes are minute tubercles, each giving rise to a hair; these tubercles are quite distinct, and about one to each segment." Thomas, Trans. Depart. Agricult. Ills., 1878, p. 112.

A very small species, *Pemphigus ulmi-fusus*, W., attacks the upper surface of the leaves of the slippery elm. The adult, winged form is only seven hundredths of an inch long. The color is dark. By puncturing the leaves they form spindle-shaped galls, about an inch long.

In addition to what has been said concerning remedies, it may be said, that since the aphides and their allies are not leaf-eating, but leaf-piercing and sucking insects, applications of Paris green and the like, which are efficacious in the case of leaf-eaters, are of little use, since these are applied only to the surface of the leaves which these insects do not eat and cannot penetrate to the juices of the plant upon which they live. Alkaline washes or such as injure the soft bodies of the aphides are of most avail, although the fumigation with tobacco, as florists fumigate their greenhouses, using a tent to cover the trees, could be made useful if trees were not too large as also the use of hydrocyanic acid already mentioned. In no group of insects is it so important that the remedy be applied promptly, for none so soon get beyond the reach of remedies. And when once they have thoroughly occupied a large tree it is almost impossible to wholly dislodge them.

The fourth family of plant lice, the *Psyllidæ*, needs no description here, for, so far as I am aware, none of the insects which it includes infest the elm, at least to any noticeable extent.

As has already been stated, the writer has in this paper attempted a full list of elm-infesting insects, and it is believed that, while doubtless some species now and then found destroying some part of this tree have been omitted, the list is tolerably complete. It has not been possible to present a full account of each of the species enumerated, in some cases for lack of space, in others because the life history is not fully known, but I believe that in most cases enough has been stated to enable those who desire to to identify the insect under consideration. It has been the hope of the writer that such a gathering together of the insect foes of a single tree might prove useful, not only to those who with him love and admire this magnificent species, the glory of our village streets, the chief adornment of our meadows, and who wish in every possible way to preserve their elms in soundness and vigor, that they may attain their fullest beauty, but that it may also be of some value, as a convenient reference, to students of entomology.

VERMONT FARMERS AND FARMS.

BY WILLIAM CHAPIN, MEMBER OF THE BOARD OF AGRICULTURE.

Vermont is a State of farmers and farms. At the close of the long wars between the English colonists and the French and Indians, which terminated in the surrender of the Canadas to the British, about 1760, the first permanent settlement of this State began. Half the towns of the State were granted and chartered by the royal governor of New Hampshire, previous to the revolutionary war. In many of these towns settlements were begun from 1760 to 1765, mostly by people from Connecticut, with some from Massachusetts and New Hampshire, and other colonies. Those people who came here from the older colonies, came as farmers; they came to find farms; to make for themselves homes in the beautiful valleys and on the pleasant hills; they came to clear away the forests, and to cultivate and improve the land; they came to bring civilization with all its wealth of blessings, where before had been only a howling wilderness; they built roads, and bridges, schools and churches; aye, better than all, they built, maintained, and defended one of the best and freest State governments the world has ever known. Honor and praise be to those grand old farmers of the last century! rarely have their achievements been equaled—never excelled!

Truly, "there were giants in those days," not only in the stalwart form and perfect physique, but strong in mental balance, in dauntless courage, in heroic faith. Looking, after more than a hundred years, at their noble deeds, their lofty patriotism, their sound and sagacious statesmanship, it almost seems that the pioneer farmers of Vermont, "The Green Mountain Boys," must have been picked men, noted, not only for wisdom and virtue, but for strength, courage, endurance and *pluck*. Mark you, when troublesome times came on, a conflict of titles, wars and fightings how dauntlessly these yeomen stood. As Eastman's "Uncle Jerry," says:

"The Old Thirteen united, fought
The revolution through,
While single-handed Old Vermont
Fought them, and England too—
She 'd Massachusetts and New York,
And—as the record stands,
New Hampshire, England, Guilford, and
The Union on her hands—

Yet, still her single star above
Her hills triumphant shone,
And when the smoke of battle passed—
She'd whipped them all—alone."

Let us briefly note the histories of a few of these farmer heroes. First and foremost came Ethan Allen, the leader and lion of his tribe, who came to Vermont in 1776, at the age of twenty-nine years, settled on a farm, and built a house in the town of Sunderland, where his first wife died, and he was a resident in that town and in Bennington and Arlington till after the close of the war. In 1787, he settled on a beautiful tract of intervale land, north of the now city of Burlington, later known as the Van Ness farm; here he lived until his death occurred, February 11, 1789. He died as he had lived, a farmer, having been to South Hero the day before after a load of hay, with his oxen and a negro driver. Allen was found unconscious on the load on their arrival at Burlington, and died the same day. It is not my purpose to record the daring deeds of this noble chief. As Washington was a terror to the enemies of American Independence, so was Ethan Allen a terror to the enemies of Vermont. The history of his exploits is familiar to you all. I only wish to emphasize the fact, too often forgotten, *that Ethan Allen was a farmer.* When I stood a few weeks ago beside that noble granite monument at his grave by Winooski Falls, and read those fitting tributes to his memory, cut in solid rock, I could but wish that others of that heroic band might find some recognition from the State to which they gave "their lives, their fortunes and their sacred honor."

Another Vermont farmer, who may be said to have been the "right bower" of Ethan Allen in the early struggle for the independence of Vermont, was Col. Seth Warner, younger by six years than Allen. He came to Vermont in 1765, at the age of twenty-two, settled on a farm in the northern part of Bennington, where he lived, when not absent in the service of his State or nation, until the summer of 1784, when failing health led him to return to his native town, Woodbury, Conn., where he died in December of that year, in the forty-second year of his age. His monument, erected by order of the General Assembly of the State of Connecticut, A. D. 1859, says (North Side) "Captor of Crown Point, commander of the Green Mountain Boys at the repulse of Carlton at Longuiel, and in the battle at Hubbardton, and the associate of Stark in the victory at Bennington."

(South Side) "Distinguished as a successful defender of the New Hampshire grants, and for bravery, sagacity, energy and humanity, as a partisan officer in the war of the revolution." Thanks to old Connecticut for doing what Vermont ought to have done long ago. Col. Warner was not only a brave soldier, but a gentleman, a Christian, and a farmer—a noble type of the man of that day,

"When councils and committees were
Our only legislators,
And Seth and Ethan of the law
The sole administrators."

Earlier than either Allen or Warner came Remember Baker, settling at Arlington, 1764. A soldier, a millwright, and a farmer, he was one of the most useful men in the new State; a relative and co-laborer with Ethan and Seth, he was always included with them in the rewards offered by the State of New York, for the capture of those rebels, as they were pleased to call them. In the contest with the Yorkers about land titles, Baker was arrested at his house in East Arlington, March 22, 1772, by the notorious John Munson, who being determined to have his prisoner, either dead or alive, cut and slashed Baker and his family with swords and tomahawks, cutting off one of his thumbs, and the cords of his right hand. Having rendered him insensible by their cruelties, they started for the court at Albany, which old Ethan used to call "the chancery court of hell," but a few of Baker's neighbors followed on, and rescued him near the Hudson river. Baker afterward settled at Winooski Falls, and built mills and a fort there; at the breaking out of the war in 1775, he assisted in taking Fort Frederick, at Crown Point, May 19, 1775. In September, the same year, he was shot and killed by the Indians near St. Johns, in Canada, where he was sent by Gen. Montgomery to watch the movements of the enemy. The savages cut off his head and carried it to the British camp on a pole. Thus perished at the age of thirty-five one of the bravest spirits of our early history. No man knoweth his sepulchre, and his only monument is that he lived and died for Vermont and his country.

Later in the settlement of the State, in 1774, there came to the Winooski Valley a plain, sturdy farmer, and the son of a farmer, bringing with him a wife and ten children. In mature life, and having had some legislative experience, endowed with shrewd, common sense, and a clear foresight, with pure patriotism and perfect honesty, this man was destined to have more and a better influence in the formation of the new State than any other man living. Such a man was the first President of the Council of of Safety; the first Governor; the father of the State—Thomas Chittenden. What Washington was to the whole country, Chittenden was to the new State of Vermont—the clear, level head, the pure loving heart, the patient, yet conquering will, the quiet dignity, the noble manhood—all these were his, and all were needed to pilot the ship of State through the untried waters. For eighteen years our Governor, he resigned the office just before his death, in 1797. "The memory of the just is blessed." His son-in-law, Jonas Galusia, another farmer, was Governor nine years, and his son Martin two years. A goodly record of a farmer's family, many of whose descendants are with us to day. The Central railroad passes through the old Chittenden farm in Wil-

liston, and in sight of the old house. If time allowed, I would like to tell of other pioneer farmers; of Ezra Butler, one of the first settlers of Waterbury, who besides being a life-long farmer and a preacher of the Gospel, was found worthy to be many times a Judge; twice presidential elector; once a member of Congress, and twice Governor of the State. Or of Samuel C. Crafts, three years Governor, eight years in the National House of Representatives, and for some years United States Senator. A man of much learning, a graduate of Harvard, and yet one who loved and followed the quiet pursuits of agricultural life. But time would fail me, even to name one of a thousand of the noble yeomanry who have been the pride of the State; who have stood up for her honor in peace or war, always ready for any emergency, always equal to the occasion. How, when the unexpected summons came in September, 1814, for volunteers to defend Plattsburgh and other points on the lake against 14,000 of the best veteran troops of Europe,

"They left the plowshare in the mold,
Their flocks and herds without a fold;
The sickle in the unshorn grain,
The corn half garnered on the plain;
And mustered in their simple dress
For wrongs to seek a stern redress."

Of the nearly fifty men from my native town who stood the fire of the British troops on the banks of the Saranac, almost every one was a farmer. I have given these rough sketches of a few of the farmers of the olden time, that we of the present day might think with pride of the grand old stock whence we have descended, and take courage. Many of you in every town in Vermont can recall the names, the memories, the lives and fortunes of those who settled on your farms a hundred or more years ago. I love to dwell in memory on the lives of those brave and cheerful old pioneers.

"Oft did the harvest to their sickle yield,
Their furrow oft the stubborn glebe has broke;
How jocund did they drive their team afield—
How bowed the woods beneath their sturdy stroke."

But, "our fathers, where are they?" "Do they live forever?" Nay, they are gone:

"Each in his narrow cell forever laid,
The rude forefathers of the hamlet sleep."

What they suffered, endured or enjoyed, none of this generation may ever fully know. But this we do know: that under their management and direction Vermont came to be one of the brighest, thriftiest, and bravest States in the world.

What shall we say of the men and women of this generation who have inherited the farms, and taken the places of those that

are gone? Better fed, better clothed, better housed, and with a thousand advantages which the fathers did not possess, have the present occupants of the soil made a corresponding advance in the dignity of farm life? Have we the pride, the faith, the courage and the pluck of the pioneers? Have we their ever firm determination to maintain our rights at all hazards? Have we their interest and zeal for the good government of the State and nation? their correct knowledge and keen insight as to public affairs? These are serious questions, and I leave them for your discussion.

I have not come to run down the class and generation to which I belong; neither have I come with the flattery and soft-soap of the politician, who, no matter whether the issue is *free wool* or *pulled wool*, will clap you on the back smilingly, and tell you how you are the salt of the earth; that you are wise as Solomon, bright as the sun, and keen as the sight of a diamond's eye, and that you are beautiful and good, "even as the angels of God." All this may possibly be true of some communities, but it is not safe to count on; take that sort of talk with as much discount as you would want in these days on a Western farm mortgage. The fact is, the times are just a little "out of joint" for the farming class, and the sooner we realize and face the fact, the better for us. The period of civil war was filled with evils of extravagant prices and depreciated currency; evils of demoralization, drunkenness, demagogueism and scoundrelism, that have been poured out on this generation like the damnation of hell! These evils, hardly seen or felt in the rush and roar of the conflict, in the excitement of the hour, have, as it were, gone to seed, and the second crop is worse than the first. A few of these giant weeds that clog the plow of progress, we might name: A monied codfish aristocracy; high taxation; an unequal and unjust taxation; unequal and oppressive rates of transportation by our common carriers, the railroads; humbug investment and insurance companies; counterfeit butter; giant monopolies, and trusts of all kinds; and a swarm of high-salaried State and Federal officers. These few will do for a sample of the whole lot, be the same more or less. And the burden of maintaining all this laziness, injustice, extortion, humbug, and wickedness, must, and does come largely upon the tillers of the soil. The farmer feeds them all. What wonder that we "do inwardly groan being burdened?" What wonder our farms are abandoned, deserted, or neglected, so that we have to offer premiums to get foreign immigrants to settle on the soil. Is it not high time, that we, as intelligent Vermont farmers, studied the cause, the consequence, and remedy for these evils?

The Cause—I have already alluded to one main cause of the the present depression of agriculture. The demoralization of all our financial, social, and political, as well as our moral interests by the late war. Another great cause that began some earlier than that has been the gradual giving up of the management of State and National affairs by the farmers to the lawyers, the politicians, and

the speculators. The honest, industrious, and patriotic farmer, has given place to the demagogue and the ambitious, professional politician. More and more as the years go by, this class of men seek for the offices and emoluments. Higher, and yet higher, the salaries are raised. Sharper and fiercer the competition for office, until any high State or Federal position is like the "Kingdom of Heaven" in one respect—in that, "It suffereth violence, and the violent take it by force." The self-selected leaders, few of whom are productive workers, control the caucuses—even the conventions, and manage legislation in their own interests, or in the interests of those who pay them best. The farmers, who in numbers and payment of taxes, are undeniably the first class, are for the purpose of official duties, considered last and least. My brother farmers, "*These things ought not so to be.*" How long will you suffer corporations, rich in associated capital, to run government to your disadvantage?

The Consequence—Ah! but I do not need to write of that. It is written so plain, that even the fool "who runs may read" on the face of every rural town in the State. Written on the deserted farms, with their neglected fields, fences, and buildings; aye, and on many of the inhabited ones, too, in the sad looks and despondent language of the occupant; written on our town and county records, in mortgages and foreclosures; written in the decreasing farm population at every census, caused by the emigration of our best and strongest young people; written in the decay of our country churches and schools, and the neglect of our country roads. Not very pleasant writing, to be sure, but it is there just the same, and you cannot rub it out by any cry of "Overproduction" or of "Western competition." Production is wealth, and "competition is the life of business." It is the trick of the pickpocket to get his victim to look at something unusual, or far away, while he puts in his hand. Overproduction and competition, with broader fields, may have had a temporary influence against our prosperity, but I imagine the main and inherent difficulty is nearer home, and in ourselves. The present hard times may prove a blessing, if it rouses us up in season, to view our state and standing as it is, and to provide the proper remedies.

The Remedy—"Aye, there's the rub." The doctors disagree. And not being much of a doctor, I shall not attempt to give a specific remedy. I shall not advocate high tariff or low tariff. High license or low license, nor any of the tired out subjects of the day. My general prescription would be, that we, as Vermont farmers, return again to the faith and principles of our ancestors. That we cherish in ourselves, and teach to our children, their firm purpose *to do right, and to have right done by them.* That we educate ourselves and our children as they did, for practical purposes of life, and fit ourselves to fill any station to which we may be called. That we emulate their courage, patriotism, and industry. That we detest as heartily as they did, all shams and humbugs. Let us remember that the foundation of our New England civilization

was Religious Liberty and Individual Equality, nor should we ever allow the first to degenerate into irreligious license, or the last into aristocratic inequality. Above all, let us never lose faith in God and our country. In every crisis, let our motto be, "Our country, right or wrong: we will stand by her when she is right, and when she is wrong we will try to right her." Vermont has the capacity, in food production, in lumber, and building materials, in fuel and water, to maintain a million people. Why shall we not try to have them.

Farms.—Having talked so far of the farmers, now what shall we say about the Vermont *farms?* What about the "abandoned" farms, that we hear so much of now-a-days? Simply this: that the 200,000 acres, said to be more or less deserted by their former occupants, comprise only four per cent. of our farm lands. Many of these acres are on high and rocky hills, unfit for the use of the modern farm machinery, and ought to be abandoned and left to grow timber again. Some may do to reclaim and reinhabit. Let us encourage the resettlement of all that are fit for families to live on, either by our own children, or by the immigrants from other lands. The Swedes, Norwegians, Danes, Scotch, some others, make good citizens. Let them come; there is room enough; but be sure to save all the old Puritan stock. And do not worry too much about the matter, if a few rough barren farms do revert to their natural wilderness; there will always be a demand for wood, timber, and lumber, and a farmer can harvest trees as well as any other crop. Our wooded hills break the winds and clouds; they give us good air and water; they are beautiful to the eye. That our occupied farms are growing more productive, is proved by the statistics gathered by the census takers and the Department of Agriculture. In spite of our relative loss in population, scarcity of farm help, and other discouraging circumstances, the farms of Vermont hold out nobly in the valuable and useful productions. In cattle, sheep, horses, and swine, we are well up with the other States of the Union, according to our area. In the yield per acre of grain, we are far ahead of the average. Fifty-six per cent. of Vermont's lands are productive, and 25 per cent. woodland, while the average of the United States is only 15 per cent. productive, 10 per cent. woodland. Of our farm lands 28 per cent. is tillage, 39 per cent. is grassland, 31 per cent. woodland, with less than 2 per cent. waste land. In yield of corn per acre, Vermont stands at the head, and in yield of oats per acre, she is third on the list. In wheat only a few of the States equal us in yield per acre, and those are the Rocky Mountain States and Territories, where only the best of the land is settled. The actual money value of production per acre in Vermont exceeds that of most of the States. I have taken these facts and figures mostly from the "Album of Agricultural Statistics," issued by the Secretary of Agriculture, June 10th, 1889, based on the averages of the ten years.

Yes; our farms, that have been properly taken care of, are as

good to-day as they ever were. The harvest of 1889 was remarkable for its abundance—so much grass that we hardly had help to cut it, or barns to hold it. I have traveled through the West, and Northwest, and South to the small end of Florida, and except a few sections of Iowa, New York, Pennsylvania, New Jersey, and Maryland, I have seen no better land for useful production than Vermont, and in those excepted sections land was worth nearly or quite $100 per acre. We cannot help our cold climate, and rocks and hills must be endured, for they were made here; but we may, if we will but make an united and persistent effort, avoid some of the artificial evils that have been thrust upon us by political tricksters and professional humbugs. I am no anarchist, socialist, or communist, neither do I seek for fame or office; but, as one about to retire from the scene, I say to you farmers, that the time is soon coming when you will have to stand by your colors, or be made serfs or tenants. Resist the evil by all peaceable and lawful means. Use the ballot intelligently, avoid debts and mortgages, cultivate free speech and free discussion. Let us, "if possible, live in peace with all men"; but if to maintain peace we have to fight, then, remembering the Allens, Warners, Bakers, Chittendens, and all the old former Green Mountain Boys, let us

"Strike home, and the world shall revere us,
As heroes descended from heroes."

HARD TIMES.

BY WILLIAM CHAPIN, MEMBER OF THE BOARD OF AGRICULTURE.

This is *no new complaint*; it is old as the human race. Adam and Eve, the first farmers on record, had hard times. Given a goodly farm bordering on four rivers, "with trees pleasant to the sight and good for food," and given dominion "over every living thing that moveth upon the earth"; given plenty of money, for it says in the record "the gold of that land is good," with a wife nearly of his own heart, Adam seems to have been well fixed. Yet in the very next chapter we find him foreclosed out of the beautiful "Garden of Eden" by a professional gentleman, who said God's laws were not *constitutional*, the crafty serpent, "more subtile than any beast of the field that God had made," the father of liars (and it may be of lawyers)—one who came to earth simply to "raise the devil." Hard times for poor Adam, the very ground cursed with "thorns and thistles," and he compelled by a "flaming sword" to go forth and take up an abandoned farm on the outside of Eden and receive that sentence, "In the sweat of thy face thou shalt eat bread till thou return unto the ground." Hard times indeed, and yet in faith, in humility and obedience, Adam went forth and got a good living, raised a generation of farmers, Abel, Seth, Enos, Enoch, Noah, Abraham, Isaac, Jacob and Joseph.

Hard times for the children of Israel, when compelled, by seven years of famine, to go down into Egypt, where Joseph and Pharaoh had got up the greatest *corner on corn* there is on record, and where in after years "there arose a new king over Egypt, which knew not Joseph," who "made their lives bitter with hard bondage in mortar and in brick, and in all manner of service in the field." Yet in the midst of this grievous and rigorous season of hard times there arose the man of God, Moses! a leader and a law giver, one who led them through many perils, and by long and weary journeyings up to the land of promise, "a land flowing with milk and honey," "unto a good land and large." Where, according to the promise made to Abraham, his seed were to become a great and mighty nation, a nation purified by many trials and fitted to receive "the oracles of God." A nation of shepherds and farmers, of heroes and statesmen. Such leaders as Caleb and Joshua, Gideon and Samson. Such kings as Saul, David and Solomon. Men fit to grace any nation's proudest days.

One more scripture illustration: "There was a man in the land of Uz, whose name was Job; and that man was perfect and upright, and one that feared God, and eschewed evil. And there

were born to him seven sons and three daughters. His substance also was 7,000 sheep, 3,000 camels, 500 yoke of oxen and 500 she asses, and a very great household; so that this man was the greatest of all the men of the east." Yet even this perfect and upright man had the hardest times ever recorded; delivered into the hand of that "cursed carmigole, old Satan," bereft of property and children, friends and honors; cursed "with sore boils from the sole of his foot to the crown of his head," and worse than all, with a scolding wife, who said, "Curse God, and die." Still "Job sinned not, nor charged God foolishly," but said, in humble patience, "*The Lord gave, and the Lord hath taken away; blessed be the name of the Lord.*" "*Though He slay me, yet will I trust in Him.*"

Satan, who never had a farm in all God's earth, could not corrupt this grand old farmer poet, who in the end received double all the property lost, just as many children, and the daughters were the fairest women in all the land; and Job lived a hundred and forty years and saw his sons' sons, even to the fourth generation.

Yes; the chosen people of God often had hard times. Oft by the rivers of Babylon, while in captivity, they hung their harps on the willows and wept when they remembered Zion. Oft subdued, subjugated and conquered by their enemies, slaughtered in the temple or hunted in the mountains; yet still clinging to the promise of a Messiah. Lo! in the fullness of time, foretold by prophets, heralded by singing angels, lighted into the world by a great and marvelous light, came the Savior! the Son of God! the Prince of Peace! worshiped by the shepherds as well as the wise men of the east; and "bringing glad tidings of great joy that shall be unto all men" until the end of time. So out of every trial has ever come joy and deliverance. And as it was in the beginning, so it is now, and ever shall be. By steady faith and loving works we may still attain unto a higher plane of life; and "our light afflictions work out for us a far more exceeding and eternal weight of glory," a glory not only always spiritual, but often material and temporal.

All down through the ages of history, times of depression have ever followed times of elevation. Rome had her triumphs, but there came a time of peril when Cincinnatus had to be called from his plow to conquer Rome's enemies, and to establish peace. England was once nearly conquered, and her good King Alfred forced to hide in a cowherd's hut and be scolded by the goodwife for letting the cakes burn in the ashes; but afterward he gathered his faithful followers and drove out their enemies. Columbus, sailing over the unexplored Atlantic in 1492, had hard times, poor frail ships, a disheartened and mutinous crew; he had almost turned back, but persevering one day more, lo, land ho! was the cry, and a new continent was discovered. A land where the oppressed peoples of the old world might find room to expand and grow into civil and religious liberty.

Thanks be to God for all the grand leaders in the race of human

progress; their ways have been always through hardships, but their glory and good descends to the remotest generations. Human life is certainly progressive, and we are made perfect by suffering.

Hard times for our Pilgrim Fathers, who, after many perils, landed on Plymouth Rock in December, 1620. Long and cold that first dreary winter,

> "When more than half their numbers died
> And stoutest spirits fainted—"
>
> "Alone that little handful stood,
> And savage foes lurked nigh;
> Their prayer and watchword, 'Trust in God,
> *And keep your powder dry.*'"

And from that heroic faith, from that sturdy perseverance, that noble independence "of all save the mercies of God," that liberty or death principle, came the grandest people the world has ever known. World-wide is the fame of the old New England stock, and it all came through hard times. And when came the days of 1776, when the Puritan and Cavalier colonists, north and south, joined hands to fight for independence, long and severe were their hardships. At Lexington and Bunker Hill, at Trenton and Brandywine, at Hobkirk's Hill and Eutaw Springs, and on many a hard fought field. Or while with bare and bloody feet they walked the camp at Valley Forge through the long winter. But out of suffering came victory. At Bennington, at Saratoga, and Stillwater, and finally at Yorktown. *Victory and independence!* And from a small beginning grew the greatest nation in the world. Ay, the farmers of that day had harder times than we can ever know. Dark were the days in 1861, when armed rebellion threatened the life of the nation. Hard times for the *Boys in Blue* who fought on many a deadly battle field, and still harder for those who starved and died at Andersonville and other prison pens. And sad the day in many a home,

> "With many a sweet babe fatherlesss,
> And many a widow mourning."

While—"John Brown's body lay mouldering in the grave
But his soul went marching on."

But ah! the glory of the day—

> "That brought fair wages to brave men,
> *A nation saved, a race delivered.*"

And harder times yet for the *Boys in Gray* and their families and peoples, for they had to endure equal or greater hardships, and at the end mourn for a "*lost cause.*" Yet from that seeming loss, there is slowly but surely working out the greatest gain for the people of the sunny South. The political, social and financial demoralization of the North is a worse evil to that section than the loss of slavery was to the South. And all the evils arising from that great family quarrel may be remedied in time if we will only work for that purpose in the right spirit.

But how shall we cure the present disease of hard times, so prevalent among Vermont farmers? Not by blindly denying that the disease exists; for it is too sadly true that debts and mortgages contracted in times of higher prices and poorer money, are pressing hard on the poor debtor, who with high-priced labor and low-priced products, with high taxation for small protection, can hardly pay his interest, to say nothing of the principal. Yes; the times are *hard* for the debtor class, and it is just as well to own it and face the music. What is the best remedy in this case? Why, *get out of debt*—If the debt is too big for the property you hold for it, then let the creditor take the property; let us have a National Bankrupt Law that will let the honest debtor who gives up his property out from all creditors, whether he pays a large or small per cent. on his liabilities. Our State Insolvency Law is not only *too thin* but too narrow. It is no disgrace to a man to square up in this way and start anew, if he does it honestly. And when you are out of debt, keep out as a safeguard against future hard times. With the present low price of lands and low rental of farms, nobody need have any trouble in starting. And if a man cannot get a living even at present prices of farm products, he needs to learn his trade better. But if you wish to pay up your debts, and live out your days on the old homestead, then do not try to carry too much dead weight. Cast off slothfulness, sluggishness and shiftlessness. Be vigilant, active and brave, avoid all extravagance and excess, take care of your health and your family, then every dollar you can honestly make, apply on your debt. Do not take up any side issues until you are free from that worst kind of slavery, the slavery of debt. Look well to your flocks and herds. Do not rob the soil; feed it well with plant food, and its plants, warmed by the sun, watered by the rains and dews of heaven and fed from air and earth, shall feed again both your flocks and families. Remember the sugar orchards, the forests and the fruits are sources of profit as well as pleasure. "Be aye sticking in a tree," to grow while you are sleeping. And in all farm productions strive to make the best possible article at the least possible cost. Don't sit down and whine or howl about small crops and low prices, until you have done your best to make the crop bigger and the price higher. It may be a slow process to lift a heavy debt, but by cheerful, active working and watchful, patient waiting it can be done. Hard times do not come on or go off in a day; but just so sure as a calm follows a storm, better times will come. To those that are out of debt and in fair sailing I need say but little, "They that are well need no physician." Still as of old, "*Wisdom is profitable withal to direct.*" So I say unto all who are inclined to cry "Hard times!" educate yourselves for your work, put thought and brain power into it as well as muscle and will power. Cultivate, not only the power of execution, but the power of comprehension and expression. If there is any one thing more than another that the farming class almost

universally lack, it is the power of clearly and forcibly expressing what they do know and feel. Lyceums, reading societies, farmers' clubs, granges, agricultural schools, societies and meetings with all similar organizations are great helps in this regard; and our young people especially should be encouraged to sustain these institutions. But remember always:

> "Deeds are nobler things than words are—
> Actions mightier far than boastings."

Armed with physical, mental and moral strength, we may "Bid farewell to every fear," and sing "Hard Times! come again no more."

Vermont farmers have always been masters of the situation in former days. For the first thirty years it was a continuous struggle with the forests, the Indians, the bears and the wolves, the Yorkers and the British. But we came out of it all in 1791. Then the war of 1812 to 1815, followed by the cold summer of 1816, gave us a hard time, but we soon recovered. Again the extravagance of the times brought on the crash in 1837 to 1840, when nearly half the farmers of the State failed. Most of you can remember how dark the times were from 1857 to 1862, financially, and of the grand "Panic" of 1873.

Of the present depression the causes are no doubt many, and some of them far remote. The consequences are here and now. They may be painful and must be borne, and if the true remedy, "Faith and Works," is rightly applied, we may, sooner than we now think, be able to say, "Yet out of all the Lord hath brought us by His might."

Brother farmers, let us do our full duty, and *God save the right!*

GRASS.

BY WILLIAM CHAPIN, MEMBER OF THE BOARD OF AGRICULTURE.

Vermont is a grass-growing State. Situated midway between the great lakes on the west and the ocean on the east, clouds of moisture are constantly floating over us; while our mountains continually pierce and break those clouds, causing frequent showers and abundant rain. The deep snows of our winters protect the plants from that frequent freezing and thawing that is so trying to all vegetable life. Our soils are of wonderful natural fertility, the constant decay of rocks liberate thousands of tons of plant food annually, the rains and dews bring it from the air above and the long roots of our grasses from the earth beneath. Thus watered, protected and fertilized, Vermont seems to be the favorite home of some of the best known grasses and forage plants. Ever since the "first settler" cleared the first acre of Vermont land, the grasses have been here, constantly spreading, increasing, multiplying, until today four-fifths of cleared land is covered with grass.

What the wheat crop is to the northwest, the corn to central states, the cotton to the gulf states, and the orange to Florida, so grass is to Vermont, *her great staple crop, the main anchor of her prosperity.* For from the grass, green or dried, comes mainly the cattle, the horses and the sheep, with all their varied wealth of production. The milk, butter and cheese, and the increase of her kind from the useful cow's patient labor, and wondrous strength from the oxen and bulls, and beef hides for leather, and fat from all cattle. The docility, endurance and speed of the noble horse, the wool, the juicy mutton and tender lamb, of the sheep; all these and many other necessities for our food, clothing and convenience come essentially from the grass. Probably nine-tenths of the subsistence of our flocks and herds is from the mowings and pastures. And how many animals do we feed? Nine years ago (in 1880) we had of cattle 403,705, of horses 75,215, of sheep 439,879, making 918,799 animals fed on grass and hay, and this, exclusive of all those kept in villages or on farms of less than three acres.

It is quite probable that the census to be taken next year will show at least a million of grass-consuming animals in the State, to say nothing of 100,000 hogs that ought to be fed partially on grass, (or of geese and other birds or beasts.) Look at the money value of grass and its direct or incidental products. The growth of our mowings and pastures, if it were all gathered and sold at market rates, would bring nearly or quite $20,000,000. But as this is impracticable, let us see what we do sell from it. At the same ratio

of increase in dairy products that there was from 1870 to 1880, we must now be selling

35,000,000 pounds of butter annually, worth	$7,000,000	
Beef, and store cattle.....	2,500,000	
Horses and colts.....	1,000,000	
Sheep, lambs and wool.....	2,500,000	
Hay sold.....	1,000,000	
		14,000,000
Add manurial value of hay fed.....		6,000,000
		$20,000,000

and the books just balance, but the wise farmer will so select his animals and so compound their rations as to get a margin of profit in feeding.

The profit would be more apparent if we were to reckon the grass and hay only at what it costs us, interest on the capital invested, cost of fencing, harvesting, housing, feeding, taxes, etc. Reckoning it this way the grass crop of the State does not cost over $5 per ton, or $10,000,000. These rough estimates or guesses are given merely to show the paramount importance of grass crop. There is no very reliable data to figure from later than the census of 1880. But its importance will no doubt be conceded without argument.

Then comes the *main* question of, How shall we maintain and preserve our grass fields? How increase the quantity and improve the quality of our grasses for pasture or for hay? How renew the old worn out fields? How and when to harvest and cure the grass for hay? And beyond all this, How to feed it, and to what animals? In this few minutes' talk we can only outline some of the leading ideas on these great questions.

It is probable that the soil of Vermont never produced an annual crop of grass larger than that of 1889. It may have often been of better quality and secured in better condition. The barns of the State are full to overcrowding and the pastures and fields are green up to winter. How shall we keep them so? First by keeping up the fertility. Top dress the moist and strong fields that are hard to plough, while the roots of good grasses are abundant, the second or third year from stocking down is none too soon to begin. Have the manure fine and well rotted if you can, or green and soft enough to work down to the roots of the grass with a good heavy bush. Do not disturb the plants with a harrow, unless you wish to put on new seed; many meadows are harrowed too much now by the wire tooth horse rakes. April, or the first part of May, is a good time for spring dressing, or July or August for doing it after the hay is cut. If you mow twice, just after the second cutting is the best time, but any time after the grass is cut till the next May is better than not to do it at all, for it works wonders in such moist seasons as the three last have been.

A field of three acres heavily top dressed in August, 1888, which

was the third year from stocking, yielded 14 ox loads of hay, in July 1889, some 10 to 12 tons, altogether too much for comfort of mowing or drying, or for the good quality of the hay; but it shows what can be done. Another great gain can be made by draining the wet and soft places; often a few rods of stone, tile or board drain will change a sour, stagnant swamp to good sweet land; from producing sedges, weeds, cat tails and frogs, to bearing good sweet grass that can be harvested without wearing rubber boots. Another gain is to remove the obstacles, such as stones, stumps and scattering trees from the meadows, have broader and cleaner fields for the mower, tedder and rake, take away the useless interior walls and fences with their rod wide border of briars, bushes and weeds, clean it all up and seed down with good seed and you will not only have more and better grass, but a better reputation as a farmer. The larger and cleaner the field the less it costs per ton to get the hay; and then the beauty of "Sweet fields arrayed in living green," ought to add something to the value of the farm and the happiness of the farmer.

But the fields "run out," as we say, after a while, the land gets hard, the better kinds of plants die and the poorer survive, the yield falls off from two tons to the acre to one, to three-fourths or to a half ton, it may be. What then? Shall we let the land rest? Nay, verily! If we omit mowing one year, it is worse the next, and in three years won't pay to mow at all; wild weed seeds are plenty and idle men breed lands like idle trouble. Plow up and cultivate some other crop till the land gets light, sweet and mellow again, work in plenty of manure, with the plows, if the soil be light and sandy, or with improved harrows if moist or heavy; then when you have a rich, fine seed bed, level the land and sow good seed. What seed? you say; the experience of Vermonters for a hundred years, has proved herdsgrass and red clover to be not only good, but the best for mowing fields; the same with white clover; June grass (and we ought to add orchard grass) makes a good seeding for pastures. Redtop and alsike clover make fine choice hay at the first cutting, but yield but little feed or rowen. One cutting a year is about all you get from them.

Orchard grass is good for the pastures and rich moist mowings, but it wants cutting the first time by the middle of June, when few farmers are ready for haying. On the whole, for mowing (and that is about all we seed for at this day) fifteen pounds of herdsgrass, ten pounds of red clover, three of white or alsike clover is about the right seed for an acre. Early in spring is a good time to sow it, with or without another crop as you chose, only do not sow the other crop too thick. Two bushels of oats or one and a half of wheat, rye or barley is enough to sow with grass seed. When the land is harrowed fine and ready for stocking, sow with machine or hand seedsower, and cover lightly with a smoothing harrow. Make the surface smooth with a roller, bush or other device and pick up the loose stone if there be any. It is a nice job

to seed a field to grass and should be done under the eye of the owner. Do not cut the grain too close in August or September, and let the hot sun burn up the young grass, and above all do not let the cattle spoil it by treading up or browsing down.

When to cut grass has been a much debated subject, but where it is used at home to feed dairy cows and young, growing stock, people are getting to think more alike of late. There is a decided tendency toward earlier cutting in the last few years. *Early and often*, is as good a general rule as you can make. Grass cut twice, first the last part of June, and second the last part of August, will give you more and better hay; will leave the grass plants in better condition, and the soil in equally as good state, as one cutting made the last of July. Cut at the first bloom, or just before the plants are in full vigor, and send forth new growth at once for another crop; by the last of August it will be ready to bloom and cut again; care should then be taken not to cut it too close in a dry time. Treated thus, our herdsgrass and clover both become perennial plants, and will stay in the ground for years if properly fertilized and protected. Of course, this style of grass farming makes more work and requires a higher state of cultivation, but it gives us better feed, cleaner fields, and will pay more than six per cent. on the difference in cost. Grass cut early and when green, needs more drying than when riper; in all cases, if possible, dry it thoroughly, and if you have the patience to cure it slowly, all the better. The advocates of putting in grass rather green have done much damage in Vermont. Men are always anxious to get haying along as fast as possible. There is often rivalry between neighbors to see which will get done first. So they take all too readily the false doctrine of putting green or damp hay into the mows. The result is heating, which causes black, dusty, mouldy, or rotten hay, often worthless, sometimes injurious. Mow when the grass is free from moisture, if you can; wilt it thoroughly, then put it in cocks of fifty or more pounds each, and let it stand till the weather is right to give it a few hours' sun and air. Hay made this way will be nice, sweet and fragrant, not overdried, nor underdried. Have a silo to preserve green fodder, if you want one, but do not try to make one of your haymow; fodder can be preserved either green or dry, but half way between it is a very doubtful experiment. Wire-tooth tedders and rakes are useful, but do not use them too much; do not shake the leaves all off the clover, nor rake the other grasses up by the roots.

A word about the pastures, and that word is, *take care of them*, or else let them grow up to woods again. Grass not only wants the *earth*, but it wants the sun, the air, the rain and dews of heaven—so keep down the bushes, brakes and weeds. Mow down, cut down, dig out, pull out, any way to destroy and kill them. Encourage the best grasses by scattering the good seed, by top-dressing, and by judicious feeding. Have neither too much nor too little stock for your pasture. Have a good fence around it, and then keep your cattle and other stock there when out of doors,

from the time you turn out in the spring till the grazing season is over. Let it be a permanent summer home for them; the stock will be more contented, the pasture just as good, and the mowings vastly better than to have the stock run all over the farm. When animals want more than the pasture affords, give it to them in the barn. It may make more work, or it may not; but it will certainly give better pay in the long run, and is a better style of farming.

Brother farmers of Vermont: We have received a glorious inheritance of waving woods and grassy fields; let us labor to transmit this inheritance unimpaired and undiminished to our children. The great statesman, Daniel Webster, when dying at his Marshfield farm, asked to be lifted to the window, that he might look once more on the grassy fields and the patient oxen in the green pastures; then sinking back on his dying bed, his last words were: "I still live!" Webster lives in the hearts of New Englanders for the good he did. So may we, in our humble calling, if with faith and works we do the best we can, still live in the hearts and memories of those who survive us. And when, worn and weary of this world, our souls grow faint within us, gladly may we take up the language of that grandest of all Psalms, "The Lord is my Shepherd, I shall not want. He maketh me to lie down in green pastures; He leadeth me beside the still waters; He restoreth my soul."

REMOVING OBSTACLES.

Why is it that our own beloved State, Vermont, the land of the Green Mountains and "Green Mountain Boys," stands still and relatively falls behind her sister States in the grand race of progress that is going on throughout this whole Yankee Nation? Why is it that the last census shows for Vermont a gain of but one half of one per cent. in population, while New York, on our west border, gains 16 per cent., Massachusetts on the south, 18 per cent., and even rocky New Hampshire on the east makes eighteen times as large a per cent. of gain as we do? Something is wrong, and the pertinent inquiry ought to be, What is it? and, How shall it be remedied? Perhaps many things may be in the way, but what is the greatest hindrance? For Vermonters are like their first gallant leader Ethan Allen who said "Of the choice of evils I always take the biggest. It is the sign of a —— coward to take the least." That is the true doctrine when we wish to abolish the evils that surround us and hinder our prosperity. Let us then candidly consider what our great hindrances are and try to study out some remedy. The world *does* move and we must keep up, or be lost sight of in the grand procession of progress.

Vermont is largely an agricultural State; without a mile of sea coast, and with but little lake or river navigation, she can never expect to engage extensively in commerce or trade with other nations or States. And although she has abundant facilities for manufacturing various articles from the wood of her forests, the iron and copper from her mines, the marble, granite and slate from her quarries, and the wool from her flocks of sheep; yet until the rate of transportation of the raw materials and the manufactured products by the railroads are greatly reduced, Vermont can never be a manufacturing State. And so upon the agriculture, upon the farmer, must and will come the labor and responsibility of keeping up the population, the wealth, the prosperity of the State, her moral, educational, social and political standing. And so the same old question comes right home to us as farmers, "What, then, shall we do?" Is it not high time that we not only find out what we want to do, but that we take off our coats and go to work all together to *do it*,

> "It strikes me this ain't just the time
> For stringing words with satisfaction.
> What's wanted now's the silent rhyme
> 'Twixt upright will and downright action."

Believing that what is needed, first and foremost, is a fair field for progress, I have taken for a text—Obstacles.

What are obstacles? Webster says, "anything that hinders progress," and gives as synonymous words, "impediment; obstruction; hindrance; difficulty." My object in this short discourse will be to show some of the obstacles that hinder our progress toward completeness, perfection and success as Vermont farmers. Obstacles may be material, like rocks and mountains, swamps, and streams; or they may be legal, like bad laws or unjust governments; a wrong custom or fashion may be an impediment, and even an impractical theory or a shiftless and despondent condition, may often prove a serious obstruction. In fact how true is the old familiar line in the hymn,

"*What various hindrances we meet.*"

If by setting forth these obstacles and consulting together as neighbors and friends, each trying to find the best remedy for the evils that are among us, around us, and upon us, we shall be led to make some of the "rough places smooth" and "the crooked places straight," then my purpose will have been fully accomplished. Large bodies always move slowly, and as the agricultural body is the largest interest in Vermont, so it may have been the slowest to move in the line of improvements; but a better day is dawning, the State and nation are waking up to the importance of this industry, so let us clear the track for the car of progress. Let us. in the true spirit of the old Green Mountain Boys and Girls, say that "An *impediment* literally strikes against our feet, checking our progress, and we remove it; an *obstacle* rises up before us in our path and we surmount it; a *difficulty* sets before us something hard to be done, and we encounter it and overcome it; a hindrance holds us back for a time, but we break away from it."

Let us take first some of the main material obstacles and see what shall be done with them. We shall hardly assume to have faith enough to "remove mountains," nor would we wish to do it if we could; they are the pride and glory of the State, they have given it the name it bears. So we will leave the mountains to grow timber for our fires and sawmills, to shelter us from the winds in winter and to break the clouds in summer causing abundant rain. Old Ethan Allen said he was glad there was one thing the Almighty could not do, that was "to make two ranges of mountains without having a valley between." There is where the Vermont farm comes in, "in the low green valleys." Alas! that so many of these farms that ought to be happy homes are now deserted and have heard the sad refrain of the emigrant's departing family—

"But alas! that we should go,
Sung the farewell voices then,
From the homesteads warm and low,
By the brook and in the glen."

Why did they go? because of the obstacles, of course.

Now the same thing may be a hindrance or a help, according to where it is placed. A lot of loose stones or boulders in a plowed field or mowing, are a serious obstacle, while the same stones and rocks laid into foundations of buildings, drains in the swamps, or walls to protect the banks of streams would serve a useful purpose. And so we say, remove the stones as fast as you can, without neglecting your stock and crops. For the smaller ones that can be readily picked up by hand, a good dump cart is the handiest conveyance. If you do not need them for drains or filling up some gully or ravine, then select some corner where the big rocks are thickest, and build an everlasting monument to your own industry. For moving large rocks a good heavy pair of oxen with stout cable chains and a drag made of 2½ inch maple or birch plank is the best ordinary arrangement; with such a rig and three good men, one to drive and two to handle the pries and rollers, etc., all rocks weighing less than two or three tons ought to be got out quite easily. Above that size you will have to resort to blasting or sinking, or to some of the many patent machines for rocklifting and moving; some of these are good and powerful, but generally cost too much for the common farmer. A rock of almost any size can be sunk out of the way if you have the patience to dig deep enough beside and under it, looking out sharp for yourself when it tips in. I have tried all these methods and handled many thousand tons of rocks, and have millions yet unmoved.

Since the advent of modern machinery for sowing, planting, cultivating and harvesting our crops, cleaner and larger fields are almost a necessity. All scattering trees in the cultivated fields should be removed. Have your groves and shade trees on the rocky or steep hills, or by the road-side. There a tree may be "a thing of beauty and a joy forever, from storm a shelter and from heat a shade," but in the field it is an obstruction and a damage. You do not need trees to shade the cows in the meadows, for no cattle ought ever to be allowed to run there. It is often easier to take up a tree by the roots than to be bothered with the stump for years. A few hours' work rightly applied will dig up the largest tree, while to take up the stump of the same tree will be a much longer and harder job. Another serious obstacle and expense on Vermont farms is the vast amount of unnecessary fence; the old walls built by our forefathers out of cobble stone or stone of all sizes that came handy, might have been useful in their day, but now, sunken into the ground, warped and twisted by the frosts, spread apart to twice their original width, bordered by weeds and infested with mice, woodchucks, snakes and other vermin, they are a nuisance in many places that ought to be cleaned up and moved away. Most of the interior field and roadside fences might be dispensed with; then more time could be given to line and pasture fences and there would be less trouble among neighbors

about straying stock. This fence tax is one of the heaviest we pay, the repairs costing over $600,000 a year in Vermont.

On most farms in this State there are more or less obstacles in the way of swamps, sloughs, mud-holes or land where surplus water stands, rendering the land unfit for cultivation and often nearly worthless for a grass crop. Now these same moist lands are apt to contain the most natural fertility of any part of the farm, and only need draining to be permanently valuable. My own experience in draining has been mainly with stone, not strictly on scientific principles, perhaps, but of practical value for all that; the general plan is to dig a ditch 1½ feet wide by 3½ deep, in the direction of the greatest fall, then lay along the sides at the bottom stones about six inches square, as near as you can get them, then cover with flat stones that will reach nearly or quite across the ditch, then pack the covering closely with smaller flattish stones to prevent the dirt from working in, then level up to within a foot of the surface with any cobble stones, and fill on the dirt—such drains have been doing good service on my farm for twenty to thirty years, and hardly ever fail where the work is thoroughly done. I should be glad to tell you about tile draining, but the trouble is I do not know much about it, only from books, and would rather spend what time I have in telling things I *do* know from actual practice. No doubt tile is better and cheaper to use when stone are not handy. Another way in which much good land can be saved on some farms is by straightening and deepening the channels of the crooked and sprawling brooks.

Having dealt somewhat with the rocks, trees, fences, and swamps, let us talk a little about the weeds, and this obstacle is common to every farm in the State. They are as plenty and as ever present as God's poor; they are always with us, in seed time and in harvest they never fail,

"The primal curse
Still clings to earth
From olden time till now."

And the curse was—"And unto Adam he said, cursed is the ground for thy sake * * * * Thorns and thistles shall it bring forth to thee."—(Gen .III :17, 18.) Well, this looks rather discouraging so far. What shall we do then? Shall we give up and bow down our head like a bulrush? Shall we quail before pigweed, pursley and plantain? Nay; verily we will not weakly surrender our birthright; but having in mind that first grand command of God to the "male and female" he had created, we will "Be fruitful, and multiply, and replenish the earth, *and subdue it*," and the weeds too. Let us go forth with the plow and harrow to mellow up the land for the "good seed," then let the cultivator and the hoe do their perfect work on the annual weeds, see that none of them go to seed, and that ends *them*. As to the perennial and everlasting docks, plantains, hard hacks, daisies, goldenrods, etc., etc., they must be pulled up or dug up and burned with fire; by thorough and persevering work they can be subdued, if not

killed out. There are many ways of fighting this numerous army of weeds; what's needed most is a determined will. A good way to check the growth of weeds is to keep the land well occupied in growing useful plants. "Be not overcome with evil; but overcome evil with good," applies to farming as well as morals, and nowhere better than in exterminating weeds. A full growth of grass, grain, corn or other rank growing crop, that fully covers the ground will do more toward removing the obstacle of foul weeds than much hard labor on an unoccupied field. The summer of 1887 was a remarkable one for its growth of weeds; warm and very wet all through the season of cultivation, they seemed to get the start of the proper farm crops. I was so ashamed of the weedy condition of my corn and potato fields at the last of August that I immediately harvested the corn and potatoes, plowed under the weeds, put on a good coat of manure, then sowed it thickly with winter rye, and stocked it with herdsgrass, (putting on clover seed the next spring). The rye and the grass came up quickly and lived and flourished; the weeds that were not buried too deeply came up and were killed by the winter's frost before they seeded. The result was a fine crop of rye and a clean field of grass. So by one stroke of generalship we may often put to flight an army of the aliens. Pardon me, my friends, for staying so long on this topic. These weeds have been a life-long obstacle to me.

Another obstacle to our success as farmers is the hard, mechanical condition of our land; pressed down by the deep snows incident to our northern winters; trod over by the hoof of cattle and horses for a hundred years; many of our fields have become hard, cold and sour; they want stirring up, and pulverizing, making them light and mellow, letting the light, air and frost and showers have their proper effect, to decompose, fertilize and make sweet the soil. We have the best plows, harrows and pulverizing implements in the world; let us learn to use them skillfully and effectively.

The hindrance of a cold climate we may not be able to remove, but we may be able to guard largely against the injurious effects of it, by being thoroughly prepared to get the full length of our glorious spring and summer. Our crops ought to be matured and out of the way of frosts by the first of September. Corn and potatoes adapted to this latitude, ought to ripen in from ninety to one hundred and ten days, and other grains as soon. Have your ground well plowed in the fall, and the manure well harrowed in then, or spread on in the winter; then as soon as the snow gets off, and the ground gets a little warm, commence to plant; an early frost in autumn is more to be feared than a late one in spring. A frost in May or June may be remedied by replanting, or sowing some other crop; but one in August, or the first part of September will do damage that you cannot repair. So I say, put your crops in early, especially those likely to be hurt by frost, and use early maturing varieties, as a general rule. And when fairly ripe, harvest them; do not wait for them to rot or freeze, or waste in the field.

The loss caused by keeping stock in cold stables and pens in winter is not so great as in former years, but is still much too large. This difficulty is easily overcome; boards and nails are cheaper than hay or grain. Modern mills fit and finish our lumber so nicely, that it is about as easy to make a close joint as a loose one. Make the stables and basements under them tight and warm enough not to freeze, at all, even in the coldest weather. Ventilate properly, and let in plenty of sunshine through good glass windows. Then your stock will flourish and yield a profit, if rightly fed and tended. It is yet an open question whether it pays or not to warm water for stock in winter, but one thing is certain, that is, it does pay to keep the water-tubs, tanks, or troughs, well-protected from freezing. Retain the natural warmth of spring water, and cattle love it, but ice cold water is uncomfortable and unprofitable, if not unhealthful.

The feed question I shall leave to the more scientific members of the Board, and will only say in passing, that good sweet grasses and clover, *green* or *dried*, are about as good stock feed as grows on the earth; a surplus of these is not a hindrance to our prosperity, but a lack of them is frequently a serious obstacle. Grass is the main anchor of Vermont agriculture; from it come the cattle, sheep, and horses; the butter, cheese, and wool, as it was anciently, so it is now. "All flesh is grass."

But I have already dwelt too long on the minor and material obstacles that are so familiar to us all; still there is one so great, so dark, so dismal, and so often fatal to success and happiness, that I actually dread to mention it. A material, moral, and I am sorry to say, a legal obstacle. It is the miserable, detestable "*mortgage on the farm*," aye, and often on the stock and tools, and sometimes on the very bed. It is the curse of many a family, the ruin of many a home. I will not dwell upon so sad a theme. The cure for this evil is one simple and unfailing remedy, "*keep out of debt.*" If you can own but a single rod of earth, do own it, from the center of the world up to the throne of God. And let no man have the power to take it from you by your own written consent. I sometimes almost wish there were none of those ingenious contrivances for making the rich richer and the poor poorer, allowed in our State. Do you say that a young man could never get a start in life without this way of borrowing? I can furnish you living proof to the contrary. And what a splendid solution of the vexing problem of "double taxation" it will be, when every person owns all he has possession of, and pays on just what he owns. Ours is said to be the best governed State in the Union, and yet with all our boasting of the excellence of our constitution and laws; of the honesty and integrity of our legislative, judicial, and executive officers, the fact still remains that there are some imperfections in our laws and government. I have already suggested a cure for "double taxation." What shall be the remedy for the entire or partial exemptions from taxation of the hundreds of thousands of dollars deposited in our savings banks

and in trust companies? Every man, woman and child can deposit $1,500 in these institutions, and have it, so far as he is concerned, wholly exempt from taxes. The argument in favor of this course is, that it will help the poor man, the widows and orphans; the facts are, that the larger part of this immense sum belongs to the rich and well-off people, who are abundantly able to pay full taxes on it. It reminds me of the plea of the man, who had murdered his father and mother, when he asked the judge, in view of mitigation of his sentence for that crime, "*to remember that he was a poor orphan.*" Then what vast amounts are exempt in machinery, mills, factories, mines, quarries, etc.; property owned by rich corporations, who ask the full protection of our laws, yet contribute nothing to support government. We might with almost equal propriety ask the exemption on the 300,000 cows in the State, that are a part of the machinery for making butter and cheese. The remedy should be equal laws and equal rights.

And how is it about equal taxation? The farmer's property in real estate and live stock is always visible to the assessor and is appraised at its true cash value. According to the statistics gathered by William P. Dillingham, under an act of 1884, the average tax on the grand list of farm property was 125 cents on the dollar per year, for the years 1884 and 1885, that is $1.25 on every $100. Now the savings banks pay but 60 cents tax on that amount, and some of the other corporations even less than that. Take the 1,000 miles of railroad in Vermont, worth with all its equipments and appurtenances (valued at half price) $30,000,000; that would make a grand list of $300,000—125 cents on the dollar of that would give us an annual tax of $375,000. The amount they actually did pay was, in 1884, $93,386.27, and in 1885, $87,445.99, or in two years about half what they ought to pay in one. These are but samples of the unequaled and unjust discrimination in taxation against farmers and all other men whose property goes into the grand list. Other instances of still broader inequality might be given if time allowed. I do not cite these out of any ill-will towards the banks or the railroads, for I am a stockholder in both, although my twenty shares of the original Vermont Central stock is valued only for having the autographs of such distinguished men as Charles Paine, Josiah Quincy and Samuel H. Walley. I mention these cases simply to show the plain, indisputable facts as to taxation.

Our social and political standing is of course more a matter of customs and fashion than of law. But to see the farmer who tills God's earth, who feeds the world, and who is by his surroundings brought nearer to nature and to nature's God, put behind the professional man, the mercantile man, or even the common carrier, is a grievous wrong. Our national constitution forbids any title of nobility: why, then, should we have any aristocracy of wealth, profession or monopoly? Why not consider "An honest man's the noblest work of God," let him be of what calling he will? Why not say, with our dear Lord Jesus Christ, that "Whosoever knoweth the will of

My Father, and doeth it, the same is My brother and sister and mother?" And yet we know that in all the great gatherings of the church or state, the farmer and his family do not come to the front, if they come at all. Look at our office holders; county, State and national! Do you find my farmers among them? Nay, verily; they are few and far between, rarer than white crows or honest Indians. It was not thus in the days of George Washington and Thomas Chittenden, nor need it be so any longer, if we will only have the courage and intelligence to establish new customs and fashions. With their vast preponderance in numbers, the agricultural class need not take back seats forever in this great country if they will only work together.

But after all, brother farmers, the greatest hindrances to our success are probably within ourselves. Our lack of faith in our calling; our want of confidence in our own ability to study and to know the things we ought to know; our imperfect practice of the great art and science of cultivating the soil; our lack of sociability and lack of confidence in one another—these and many like failings are hindrances that we can overcome only by earnest effort, by study, by experiment, by patient practice and by using every means of improvement that we can find. We ought to be ashamed to lack faith in our occupation, for of all the ways that men have sought out to get a living, farming seems to be the most natural, the most noble. According to sacred history, man was created to "replenish the earth and subdue it," "to have dominion over the cattle, and over all the earth"; and when driven out of Eden it was "to till the ground whence he was taken." We may not hope or expect perfect happiness in any calling or station in this life, but surely we can come as near it by carrying out the original design of our Creator as in any way. Let us, then, comfort ourselves with the thought that we are in the same line with the patriarchs and holy men of old, and with the best, the wisest and most noble men of all ages.

Nor ought we to lack confidence in our ability to study out and to know all that is necessary for us to know, to attain the highest human enjoyment, to fill the highest positions in public life, and to feel easy and self-possessed anywhere and at all times.

But you may say "the farmer cannot be a lawyer, a doctor, a preacher, a politician or a poet, or excel in any of the so-called higher classes of labor." I say very emphatically that the farmer and his wife and children *can* and *ought* to know a great deal about all of these things; and if we would but give our bright boys and girls a fair chance they would know enough for all the practical purposes of life. Any bright boy can learn all that is important in our statute laws in a few months' time, and "common law" is but "common sense" and a sense of right, as settled by the wisdom of ages. The laws of health and the effect of medicinal and surgical remedies for disease are comparatively easy to learn. A person who reads the Bible carefully and prayerfully, ought to be able to preach the sermon of "a well ordered life and a Godly con-

versation" before his neighbors, and that is about the best sort of preaching. The Christian man who is constantly among nature's works will be a poet in spite of himself. He may not write it in words as did those other farmer poets, Job, David or Robert Burns, but the spirit and sublimity of it will be in him, upon him and round about him. So I say, a farmer can be anything that any human being can.

But how about the political life that is so active among us now-a-days; has the farmer much to do with that? Yes; much every way (except holding the higher offices). What is politics? Let me give Webster's definition: "The regulation and government of a nation or State, the preservation of its safety, peace and prosperity; the defence of its existence and rights against foreign control or conquest, the augmentation of its strength and resources, and the protection of its citizens in their rights, with the preservation and improvement of their morals." This is pure politics, *it is principles not parties*, although parties may be necessary to carry out the principles. Every man, woman or child ought to learn the principles and politics on which our nation has been founded and on which it has grown to be one of the mighty ones of earth. Formerly a large proportion of the men who became eminent in the nation received their early training on the farm. It should be so again, and would be if we would but let our boys attend the courts, conventions, and sessions of the legislature more; let them learn what public life is, and how to perform its duties. It is a great thing to be a citizen of this American Republic, known as United States, and it is well worth the while to be an intelligent one.

It would be difficult to name all the obstacles, to tell all that hinders, or all that helps. Every farmer among the ten thousand hills of Vermont, has his own peculiar surroundings and circumstances; differences in situation, soil, elevation, pitch, moisture, fertility, etc.,—differences in his help, family, fortune, needs and tastes. No two cases are just alike, nor can any two be correctly or definitely advised alike in all things. So I have considered, in this paper, mainly those ideas that are general and applicable to us all. If any part of the argument is wrong; may your practice be right. Among so many obstacles I may have stumbled; if so, please pick me up and set me in the right way. Beyond all this dark cloud of obstacles I firmly believe there is a brighter day for Vermont agriculture. A day of better practices in farming; a day of broader culture for the farmer and his family; a time when the waste places shall be built up and Vermont have 500,000 inhabitants; a time of peace, prosperity and happiness, a time of the

"Loo of cattle and song of birds
And health and quiet and loving words."

Such a time is worth toiling for, striving for, and, if need be, fighting for.

"Then forward; the State that was first in the fight,
When *Allen* and Warner were here,
Should not be the last to strike now for the right,
Should never be found in the rear."

GILT-EDGE BUTTER.

BY M. W. DAVIS, MEMBER OF THE BOARD OF AGRICULTURE.

The announcement of this subject may startle those who think that there should be no need of writing any more upon it. This subject has been written upon, line upon line, precept upon precept. Men and women of experience who have stood for years at the head of the dairy have boldly declared what this article should be, and from time to time they have thrown upon the market, in limited quantities, what they considered to be gilt-edge butter; and yet there is still need of more writing, and more of missionary work before the large part of the butter of our State can properly be called gilt-edge butter. It appears to me that for the present the dairy is the largest hope of Vermont farming, and it is well adapted to the soil and climate of Vermont; that it must ever be one of the leading industries; and in this age of exceedingly sharp competition, the art of butter-making must be most practically studied, and the manufacturer make use of the brain as well as the hands, to aid him in bringing his production to a higher standard of excellence. Too much praise cannot be given to those inventors of dairy utensils who have so largely aided to lighten the labors of butter-makers. If we look along the line of dairy exhibits to-day, as compared with those of fifteen years ago, we see a much larger per cent. of what is called gilt-edge butter, but in many large exhibits, even to-day, we will not infrequently find packages considered by their makers to be first-class, that the judges will score far below the first-class standard.

This term, gilt-edge, is a modern term, and is used throughout all business circles, but it does not make an unvarying standard of quality, since each butter maker has his or her own standard, which is high or low, according to the opportunities that the person has had of observing the quality of butter in the large markets, where the best from all over the country is constantly on hand. From the increased developement in the art of butter-making, we find continually a much larger per cent. of really good butter, and many who thought years ago that they had attained to the highest degree of excellence in the manufacture of this produce, because it was the best that they or their neghbors knew anything about, have lately found it necessary to advance still farther toward the goal of perfect butter. While our farmers have been struggling for years and years, they are still considered to be making but about thirty per cent. of good butter, that is, even in our day and generation, with all

the improved dairy apparatus, out of every thousand pounds of butter made in this State, seven hundred would not rank as first-class, and but three hundred would deserve the name of good butter, and but a small part of this would be worthy the name of gilt-edge butter. As it is necessary to increase the quality of butter made in this State, in order to make a profit from dairying, you will see the absolute necessity of reiterating the old, old story in regard to butter-making. For these many years has this Board urged the necessity of making a better article, and they feel assured that there has been a marked improvement; still the top round in the ladder has not yet been reached by hundreds who may attain it.

Now, while I attempt to define and to systematize the methods of butter-making, do not think that I consider myself infallible in the matter, but treat what I have to say rather as suggestive than as conclusive. What, then, is gilt-edge butter? It is that article which will scale a hundred points, an article properly balanced and perfect in grain, texture, color, flavor, salting and aroma. You ask, who is the judge in this matter; here you will find that the standard is not unvarying, for the best experts, the most fastidious epicures will differ slightly in their opinions; but to this goal of excellence all should strive in manufacturing butter. For the last ten years this Board has emphatically urged the importance of co-operative creamery associations, and they have emphasized it particularly for the past two years, as one of the cheapest ways of decreasing the amount of poor butter made in the State, that thereby the poor butter-maker might be of necessity compelled to put into other hands the work of manufacturing his milk, so that the quality of the butter as a whole might be raised.

In the manufacture of gilt-edge butter, the first step, the prime factor, yea, more, the very foundation, is the cow. Upon this subject I cannot say too much or talk too long and emphatically. We have all urged the necessity of weeding out the poor butter cows, the necessity of breeding better, and of feeding better, for in order to make gilt-edge butter you must have a gilt-edge butter cow. Such a cow is so constituted that she will produce milk containing butter fats having the characteristics of good butter. But let me say, that these characteristics are born with the cow; they are a part of her individuality. She has the power to digest her food, and from it in her system to manufacture the flavor and aroma, which is pronounced by the best judges to be that belonging to perfect butter. She should also furnish sufficient coloring matter at all seasons of the year, that the product may stand on the merits of its own color, without needing the addition of artificial color, which has lately been considered as an adulteration. No man or woman can make gilt-edge butter without having this true gilt-edge butter cow, and this cow must be kept in a healthy condition, that pure blood may flow freely through her veins from which to manufacture pure milk. She must have properly balanced food, fed regularly, both as to time and quantity; it must be palatable, and of such a nature as to be easily digested.

She must have sufficient exercise, plenty of pure air and pure water, for the cow is a machine that can do nothing but use the materials furnished her, not create them. Hence all variations in the food and the health of the cow affect the quality and the quantity of the product. She has no power to make any larger or better production than is in the food she is consuming; therefore, again I say to the butter-maker who desires to make gilt-edge butter, unless you have the cow here described, and are willing to keep her away from all contaminating influences in the air she breathes, in the food she eats, and the water she drinks, it is vain for you to try to succeed. But with such a cow, you are able to make successfully one step toward the manufacture of gilt-edge butter, that is, you will be able to produce pure milk, from which to begin the process of manufacturing the desired quality of butter. I think there are more failures in the manufacture of fine butter that trace back to this one part of the process than all the rest combined.

I remember forty years ago, when running a country store, it was customary to take all kinds, qualities and quantities of butter; an elderly lady, who was a fair housekeeper, though her neatness could hardly be said to be next to her Godliness, was in the habit of bringing to my store the butter from her one cow. This butter was of high color at all seasons of the year, of firm texture, even in midsummer, though in those days a cow never saw grain, their only feed being pasture and hay. Here was a gilt-edge butter cow, and to-day I know of a person in our vicinity, who would not be selected for her neatness, but this woman brings butter into our village that surpasses anything that I meet in solidity, color, and grain. Break off a piece from a cake of it, and the break shows the grain like that on a piece of granite. She has this individual cow adapted by nature for this specific purpose. Hence many a housewife has been underrated as a butter-maker, because she had not at her disposal the milk from a true butter cow properly kept.

When perfect milk is drawn from the udder it is extremely sensitive fluid. It contains, at the outset, more or less animal odors, and during the process of cooling absorbs any other odors that are present. Hence the milk should be strained as soon as possible, and placed away from the chances of being contaminated; also placed where it will receive no agitation or jolting. It should remain at an even temperature, from 57° to 65°, depending upon the cow, her feed, and condition; allow complete oxidation to go on until the proper amount of decomposition takes place. When the cream is removed, cool to low enough temperature to prevent its further souring, and hold it to that temperature till all the cream is on hand that is to be used for that churning; then mix all together, stir well, and completely, then bring it to a higher temperature for ripening, and all will ripen alike. But it should be remembered that all of this time it should be kept carefully away from the possibility of absorbing any bad odors. The cream should be churned until the butter comes in little grains, about the

size of kernels of wheat, the buttermilk drawn off, and pure, cold water added. The churn should be carefully agitated without having the butter particles mass. This should be repeated two or three times, until the buttermilk has been thoroughly washed out. The salting may be done at this stage of the process or later; whenever done, do not spoil a good article of butter by using poor salt. Get the best salt you can find; the best salt costs but a little more than the poor grades. The salting may be done on the worker, but before using the worker look well to what you are doing, for tons of butter have been practically ruined in the working. Butter does not need working; all it wants is sufficient pressing together to expel the water and evenly distribute the salt. The butter is improved by allowing it to stand a few hours in a cool place after adding the salt, as it allows the salt to be more evenly distributed, and adds to the firmness and deepness of the color, and increases the aroma, all of which properties secure an article in better condition for any style of packing. If the butter is to be used at once it may be put in prints or small packages. If held, it better be put in large tubs, and if properly prepared, will still be gilt-edge butter six months or a year hence. It is possible to make butter of good quality by the shortest of processes, forcing the cream to a complete separation in a very few hours, by either extreme cold or heat, the butter being salted, worked, and packed directly from the churn, and used as fast as made.

I am not attacking any of your improvement systems of milk-settings of factory manufacturing, for they turn out a good article, and their advent has materially raised the standard of excellence of Vermont's butter product and at the same time materially lessened the labor. But the watchword should still be progress, and the highest round in the ladder is still far, far above the mass of our dairymen; therefore, to this end keep continually striving to improve the quality of your butter. But one says, will it pay? No other kind of butter will pay except the gilt-edge, or that which is approximate toward it, and as you approach near to perfection in the quality of the product, you will at the same time increase the profits in its manufacture.

If one has a phenomenal butter cow as now required, and otherwise well cared for, she will produce a milk of such good quality as to make a fair article of butter even on poor manipulation, but it is only when this good milk is added, with care in all the minor details, that we can hope to produce the gilt-edge article, that will find a ready market at forty to fifty cents a pound. Perfect cleanliness of all utensils must always be observed. It will be noticed that I have been speaking more particularly of open, shallow setting for the production of the highest grade of butter, since I believe that the majority of the butter of Vermont is, and will be, made at the farmers' homes, and also believe that the keeping properties in butter will be, and should be, the essential in its value, and also believing that butter made from open, shallow pans is more likely to keep than that made in other ways. I am

aware that a strong effort is being made to push sweet cream butter to the front, and some have written articles declaring that sour cream butter was soon to be a thing of the past. I advise the saving of labor and quickness in the handling of milk and cream, and like sweet cream butter, but like ripened cream butter better, and if I buy of that butter enough for a day, week, or month, if properly made, I shall have perfect butter to the end with less money invested in brine and caseine, and with much less anxiety as to whether the sweet cream butter will come to-morrow; for those who use sweet cream butter cannot be without it, and must have small and frequent supplies. It is too much like fresh fish and veal steak: it must be consumed at once or lost.

The object of this paper is not to attack the new systems of butter-making, but to warn the dairymen against thinking that every new device used will raise the quality of butter. I firmly believe that modern methods cannot produce any better grade of butter than those methods formerly used.

But, says some one, how can I obtain the kind of cows of which you have been speaking. My friend, you must learn from observation to know her at sight. She carries upon her exterior the marks of her own qualities, some of which are as follows: fair size, good constitution and digestive organs, fine, mellow skin, broad hips, broad, deep udder, large, long crooked milk veins, disappearing far forward, in a large reservoir; of a somewhat nervous temperament, and yet quiet and gentle. Cows having these external indications, if sound and healthy, will usually prove all right, but the only way to be perfectly sure about the cow is to milk her, set the milk and churn the cream. Sell no cow unless you have tested her, neither keep any that do not come up to your standard. Be careful not to be prejudiced towards any cow on account of her breed. Again remember, that in the art of making the highest grade of butter, there are numerous essential factors, numerous links to the chains, and they must be unbroken if the result is to be perfect. At any stage in the process the work may be spoiled. Then with double zeal let this industry be backed by the good people of our State, until on every farm adapted to dairying there shall be written upon every dairy room, GILT-EDGE BUTTER.

CORN FODDER AND ENSILAGE.

BY HOMER W. VAIL, MEMBER OF THE BOARD OF AGRICULTURE.

Ensilage as a word derived its origin from the French method of preserving roots. They had a practice of digging trenches in which they placed their roots, and next came the practice of putting in clover hay, and from this process came our present silo and our present method of preserving crops in the silo. This method was first made known in Vermont at a farmers' convention at St. Albans, when an old sea captain, Capt. Morton, took some samples to that convention. He told of the amount of stock he was keeping, and amount of corn he raised to the acre, and the amount of its feeding value. The amount of stock he was feeding was wonderful. There were a great many people from this State and other places, who visited his silo, they found the ensilage as was represented, but they were also disappointed that the ensilage should have such an odor. I was told that it was on the same principle of canning fruit, and I was expecting the corn to come out like corn, but the one thing that impressed me was the disagreeable odor. The taste of it was a taste of vinegar and was disappointing.

It was some years after this convention that a severe drought cut down my hay, and I fell back upon ensilage with a faint hope that it might be of some relief to me as a fodder for my cows. I plowed up about four or five acres of old pasture land put on two or three hundred weight of phosphate to the acre and sowed it to Western corn. I was not taking good pasture land. This corn came up very slowly, it was yellow and backward; but some time in August I went into the field, after we had had a week or two of good corn weather, and I was surprised at the growth of that corn; it was as high as my head. I saw at once that I must prepare for my silo. I built my silo in the barn, as I paid nothing for the carpenter work, the cost of it was fifteen dollars. I filled the silo with the corn, and I believe I never have bought a particle of hay from that time on, and that was seven or eight years ago.

I have had some experience with other crops beside corn, having put in peas and oats, sometimes rye and sometimes clover, just as the crops happened to be the handiest for me to use at the me. I have been very successful in preserving them and also successful in feeding them. Corn will always be the most economical crop for ensilage for the reason that so much more can be raised to the acre. Corn is the main ensilage crop as well as the main forage crop of the State.

Clover and early cut rye, oats and peas have a high feeding ratio but the odor is more offensive than that of corn. The cattle eat them very well. I want to say a word in relation to building a silo. It was thought in the early days of ensilage that the silo must be made of brick or stone, but wooden silos are very much the cheapest and also the best. My silo is wood, made of double board with tar paper between the two boards, and is practically air tight. The practice is to coat the outside of the silo with coal tar or something of that nature, and preserve the wood in that way. Coal tar makes a very good coating.

The question of whether ensilage should be cut or uncut is one which has been discussed a good deal, and it is one of considerable interest to us. It was thought at one time that it must be cut, but it keeps even better not to cut it. It is very much more work to take out the uncut fodder, and it is more expensive to get the fodder cut when it is taken out. In a large silo there is no way but to cut the fodder. I have never practiced putting in the corn uncut, but I understand when it is put in in that way that the layers must be put in straight, all the stalks lying in the same direction. Cattle will eat the uncut as well as the cut. You remember that a year ago this fall we had a frost, a very severe frost, on the other side of a mountain, which destroyed the whole corn crop. In our part of the State there were a great many silos immediately put up, and the corn put right into them, and by so doing there was comparatively little loss. I speak of this to show the advantage of silo as protection against frost. If the corn is put in at once there is but very little waste. I have never had as good ensilage as when I put it in after that frost, and the experience of that frost increased the silos in my part of the State.

One of the advantages of the ensilage over the dry fodder is the liking which all stock seem to have for it. My stock, my cows particularly, will leave any kind of grain or the best hay which I have ever fed for ensilage. There is nothing that they seem to like so well, unless it is apples, and they seem to have the same craving for ensilage when it is at its best. Men who have had experience with ensilage tell us that as compared with dry fodder there is no great difference in the expense of drying or putting it into the silo. That putting it into the silo about balances the expense of drying it and the loss is about equal under the very best of circumstances and conditions. There is loss either way. There is loss of putting corn into the silo; every part of this acid or vinegar has lost its feeding value. But there is something beside feeding value to be thought of; there is the health of the cow; if you are feeding cows, they seem to demand something of a succulent nature when they are being fed on dry hay and they show the effect of it. Sometimes I have fed my cows on some succulent food, and I have noticed a gain in both milk and butter without increasing the grain ration at all. There are several other advantages which come along with the health of the animal, as, for instance, with my cattle I have had less of inflammatory diseases, such as garget.

All animals are very fond of this food. It is fed to sheep, poultry and horses, though working horses should be fed very little. This food seems to keep down fever and keeps the system of the animals in a proper condition. I know of a good many farmers that keep their work horses in the barn all summer and winter and never think of giving them a little cooling ration and change of diet. I think it is a mistake in feeding many animals that we do not have some of those succulent fodders to work in some time or other to keep down fever. This is one of the great advantages of the silo. Those men that are looking ahead into the future tell us that there is going to be a great deal more soiling and less pasturing, that we are going to feed more in the summer time, that we must prepare our forage crops for carrying the cattle over the dry season of the summer, and I am looking in the future for the silo to do a good work in that way. The best time for feeding ensilage is in the winter. I want to say a word in regard to the relative difference of stacking this corn feed and putting it into the silo. It is true that to pack this fodder corn in very large stooks that will hold a half load, and tie it well, the corn will keep in a splendid condition and it is a good way to keep it if one does not have a silo. It will cost some more to put the corn into the silo, but if a man is obliged to bind his corn and then carry and stook it there will be an additional expense of that, and will make full as much labor as putting into the silo. I have always weighted my silo. If you have any other crop but corn it is best to weight it very heavily. Many are feeding their cows from the cut fodder from the top of it, never putting any cover on it. It is best to weight unless one is going to feed it immediately. I cut mine fine and tread it down.

All things considered, the corn plant is the most valuable fodder plant we can raise. It produces more digestible material per acre than any other. It is adapted to quite a large share of our soils, is easily grown, and on the average is a sure crop.

The dairy is the leading interest of farmers in Vermont, and in speaking of the value of farm crops, it is natural to look at the subject more from the dairy side than any other. In figuring out the butter value per acre of the various crops, we find corn stands at the head. Take an acre of land that will produce two tons of hay, a cow that will produce a pound of butter per day will yield while eating that two tons of hay, one hundred and thirty pounds of butter. We can see then that the feeding value of land put into grass and hay that produces two tons per acre is a hundred and thirty pounds of butter per acre. Land that will yield two tons of hay might easily be made to give ten tons of corn fodder. The feeding value of that ten tons of fodder corn given to cows producing one pound of butter per day should be two hundred and twenty-five pounds of butter. If we reckon milk value instead of butter value we will arrive at the same results. While this would be a somewhat high estimate for the hay crop it would be a low estimate for the feeding value of an acre planted to corn. This shows the value of corn as a fodder plant.

WHAT VARIETY SHALL WE RAISE?

Our conditions here in Vermont are such that we have to be on the lookout for frosts. We have to get corn out of the way before frost comes, but nevertheless we want to raise a variety either for the fodder corn or for ensilage that will produce ears. When the idea of the silo first came, farmers strove entirely for weight; they sowed their corn too close and supposed that the greatest number of pounds possible was the thing to be desired, some producing even up to forty tons an acre. It is true that by taking some of the large varieties and sowing too thickly that no ears will be produced, but we can get an immense amount of weight; but this weight will be mostly water, and its feeding value will be so low that we cannot afford to raise fodder corn of this description.

The corn plant is eminently a sun-loving plant. It desires plenty of sunshine way down to its roots, and in order to get a high feeding value per pound you must have a corn plant reaching nearly to perfection, that is, you must plant it far enough apart to produce ears. It is not necessary for either fodder corn or ensilage that it should be planted three feet or three feet three inches apart each way so that it will produce large full ears such as we want if we are cultivating it for the kernels of corn, but it should produce at least some ears. In this State the Sanford corn is largely used through the northern half and seems to give very good satisfaction. In the southern half it is probable that some of the varieties that grow larger than the Sanford can be profitably used. Among such varieties can be mentioned the Red Cob, Virginia Horse Tooth, B. & W. Good results have also been obtained with larger varieties of regular field corn, such as the Pride of the North and the Angel of Midnight. Such large varieties as the B. & W. and the Virginia Horse Tooth are not usually raised unless they are to be put into the silo. The stalks are very large round, and sometimes fourteen feet high. They cannot be fed economically as dry fodder, but are excellent to be put into the silo. We want a good growth of stalks, but we do not want it all stalks. A good method of planting is in drills three feet or three feet three inches apart, and have the kernels in the drill from four to five inches apart. There is a great variety of opinions as to the proper distance of planting corn for ensilage or fodder. There is probably little difference in the feeding value per acre whether the kernels are placed four inches apart or twelve inches or in hills three feet apart. You will get less weight per acre the further apart you put the kernels, but each pound of this weight will be more valuable for feeding.

In cultivating do not use hand power any more than absolutely necessary. It is safe to use a smoothing harrow after planting and before the corn comes up and to continue harrowing until the corn is five or six inches high. The corn field will look a little rough just after the harrow has gone over but the corn will straighten up and be all right even when six inches high. On a

side hill it is hardly safe to do much harrowing, certainly not if the corn is three or four inches high. If you harrow until six inches high, a horse cultivator will be all that is needed for the rest of the work. In running a cultivator do not work the soil too deep, merely stir the surface soil; do not go deep enough to do any root pruning.

When you come to discuss the time that is best to cut the corn, you touch what might be called the chemical side of the question. This question can be answered as well probably from the chemical standpoint as any. Look for a moment at what goes on in the growth of the corn crop, and the process is much the same in the growth of cereals or the grass crop. Their period of growth can be divided into several parts. When the blade first shows, it is rich in both animal and plant food, it is easily digested, and if cut then when six or seven inches high would yield the nicest kind of fodder that could be desired. Of course no one would think of harvesting the crop then, because the total weight would be so small. From that time on until the corn begins to show the silk or tassels is the time of building up the frame work, the woody structure of the plant which is of the least value. If cut at this period of growth some weight would be obtained, but this weight would be principally water and coloring matter and have but little feeding value. Next there comes a period in which the roots by this time have gotten pretty well grown, have started out through the soil and take up what in the end they want to make the perfect corn. They begin to draw from the soil that part of the plant food most valuable in feeding our animals. They continue that process until the corn begins to glaze. It is during this period that the corn plant is making the best part of its growth. The rest of its growth from that time on is one of transfer from the leaf to stalk and the corn kernels. This transfer in all plants is accompanied by a loss of digestibility. If you were going to harvest your crop to sell the grain, of course you would want the most pounds possible in the kernels, and you would let the corn stand until thoroughly ripe, but by getting that large amount of weight you at the same time get a loss of digestibility. When you raise a crop to feed on the farm, digestible material is what you want, weight will do no good, unless this weight is to be digested by your animals you get no increase in feeding value. If the corn has finished growing at the time of glazing that would be the latest possible time to let the corn stand without loss.

When the corn crop is to be used in feeding on the farm, and the corn is raised for fodder or ensilage it is often planted so near together that the kernels will not fully form, will not actually come to a stage of glazing. In this case you can tell when the plant arrives at the proper stage of growth by the appearance of the leaves. The first sign, dying or a loss of color, indicates that the plant has reached the maximum of its growth and that process of change and transfer which we did not want has already commenced. We say then, that the proper time to cut the corn, and

this time should be the same whether we cut for fodder corn or for ensilage, is the time when the kernels begin to glaze or the leaves begin to wither.

HOW SHALL THE CROP BE HANDLED IF CUT GREEN.

Here a distinction will have to be made between fodder corn and ensilage. Up to this point the crop will be handled in the same way whether it is to be fed as dry corn fodder or put in the silo. If the corn is to be used for dry fodder, the best way to handle it is probably to bring it to the barn and set it up in large stooks, holding a half a ton, and set it up as near the barn as possible, the tops of these stooks to be bound very tightly with a cord. If the field is near the barn the corn may be stooked in the field, but there is a good deal of labor involved in breaking roads through the snow to haul out the corn when it is stooked in the open field.

It is very difficult to dry corn fodder so that it can be packed into a mow in the barn and not mould. Some succeed by putting straw in alternate layers with the corn fodder.

HOW SHALL THIS DRY CORN FODDER BE FED.

If the crop has been cut at the proper time, been treated without loss of the valuable parts, the stock will eat it up clean, even to the butts, but probably no large amount of corn raised in this State will be secured in this fine condition. Most farmers find that when they try to feed whole corn fodder there is more or less that the cattle refuse to eat, and it has to be thrown out as waste. Now in the actual feeding value, in the actual amount of the digestible animal food, the butts are fully equal to the upper part of the stalk. If then we can work up these butts in shape so that the cattle will eat them, they will give us as good a return as the upper part. For most farmers the cutting of this dry corn fodder will yield enough profit to pay for the cost of labor. A machine that will not only cut but crush or shred it will put corn fodder in such shape that the cattle will eat it much more readily than if cut straight across. Dry corn fodder as ordinarily cut has a sharp edge that is quite likely to make sore the inside of the cow's mouth. When it is shred or broken you get rid of this trouble and the corn fodder is more thoroughly consumed. If the corn fodder is a large variety and somewhat injured in the drying, or if it has become very dry it may be necessary to moisten it. Quite a number of our cattle feeders use a trough or box about three feet deep, three feet wide and eight or ten feet long. They cut this full of dry corn fodder the night before they want to feed it, for twelve hours before, throw in a few pails of water and let it stand and it softens it a little so that the cattle eat it much more readily than in the dry state. If it is not intended to cut the fodder very much the same result may be obtained by packing the

whole stalks in a stall three or four feet deep, throwing on water and treading down the mass; it will soon begin to heat, and after heating thirty-six or forty-eight hours it will be soft enough so that the cattle will eat it without waste.

Field corn that is eared has about two-thirds of its feeding value in the kernel and one-third in the stalks and leaves, but for fodder corn no such rule can be given, the proportion varying according as the ears are large or small, as the corn was planted thick or otherwise. In fodder corn the leaves and the ears or nubbins are the most valuable parts and that the stalk does not differ much in composition from the top to the bottom. Farmers are in the habit of thinking that the butts of corn stalks have no feeding value, but this is wrong. It seems pretty well determined that the lower part of the stalk is almost if not quite as good in feeding value as the upper part; the lower part is of course harder, and it is, therefore, more difficult to get the cows to eat it. The individuality of the cow has a good deal to do with its eating or rejecting this lower part.

Turning now from the dry corn fodder to the ensilage, the particular things to be sought for in building a silo, are to have it all wood, to have it as nearly air tight as possible, and to have it strong enough to resist the immense side-ways pressure. Care should be taken particularly to have the sides tied firmly together at the top and bottom. The silo should be placed as near as possible to the stable of the animals that are to be fed from it, and the bottom of the silo should not be more than four or five feet lower than the floor on which the cattle stand, and other things being equal it is better to have it level with that floor. There is no necessity of having the cost of the silo very great. If it can be made within a bay, about fifty dollars worth of material will make a silo that will hold sixty to seventy tons. But if the silo is to be built out doors, where it will be necessary to construct the four sides and the roof, it will cost nearly two dollars for each ton's capacity. The inner wall of the silo should be two thicknesses of matched boards, with building paper between, and both thicknesses of the boards should be very thoroughly painted with coal tar that has been thinned by the addition of one part of gasoline and two parts of coal tar. A wooden silo thus painted will last almost as long as a stone silo, and will be much more nearly air tight than if the paint was not used.

The silo should be deep rather than broad. If it is open at the top there should not be more surface exposed to the air than will be taken off in each day's feeding. If the air gets into the ensilage it spoils quite rapidly. You can have a silo as deep as you choose; probably eighteen to twenty feet would be the extreme limits in depth; then if the area is not large, say ten by twelve feet, you would take off a layer the whole way across each time. If much ensilage is wanted it is much better to have several small silos than one large one. How high the silo should be depends entirely on the condition of the barn in which it is built. Many barns of the

State are so arranged that one can drive into the second story, and from there it would be easy to fill a silo twenty feet deep, with the carryers that go with the cutting machines. It would be quite a task to put the ensilage in whole where the silo is made so deep. The contents should be gotten out with just as little lifting as possible, and this can be most easily done by taking it out through a side door, made in several sections, two feet wide and eighteen inches high, taking down a door as fast as the upper surface of the ensilage is lowered to it. In this way you will work from above downwards all the time. Some of the early silos had a complicated system of pockets and windlass to hoist the ensilage up over the sides and then lower it to the feeding floor. This is a poor arrangement: do all your lifting at the time of filling the silo; you hav plenty of help then and can do most of the lifting by horse power. Then for the days, weeks and months of feeding out have the work just as easy as possible.

The weight of ensilage per cubic foot varies from forty to forty-eight pounds, forty-five being a close average; in calculating capacity, however, it is always well to err on the safe side, and it will be better to calculate fifty-five cubic feet for each ton of ensilage it is desired to get into a silo.

In filling a silo there are two general methods, filling fast and filling slow. They are opposite, and yet good ensilage has been made by each method. It is not known just what changes take place in the silo, just why one load should come out nice ensilage, and another, under apparently similar conditions, should be poor ensilage. All advocates of slow filling say they wish to have the silo heat enough to preserve the ensilage; yet on the other hand we find silos every year that have been filled quickly and have never heated to an apportionable extent, and yet good ensilage comes from them. One advantage of slow filling is that more can be gotten into the silo, the ensilage settles as it heats, and allows room for a much larger quantity than could have been put in had the work been done more rapidly. It is not nceessary that the upper part of the silo be as strongly built, or as nearly air tight as the lower part. An eighteen foot silo can have the walls continued up at least six feet, and if filled to the top the ensilage will in a few days have settled below the eighteen feet. In this way the capacity of a silo can be increased with very little added cost.

In cutting corn for ensilage a self rake reaper can be used to good advantage, though it is a little hard on the machine. A useful wagon for hauling the corn fodder to the silo can be made by laying a long plank from one axle to the other in an ordinary lumber wagon, so that the load of corn fodder should be long and low instead of being short and high. The ensilage can be put into the silo whole or cut. Just as good ensilage has been made from whole corn fodder as from that which is cut. Good ensilage should not be changed much from what it was when the fodder was put into the silo. Of course as soon as the air gets in it will begin to act on the ensilage to change the color, but when the silo is first open-

ed the corn stalks ought to look much the same as they did when first put in, and ought to be of the same color and with not much sour smell. The cows apparently like poor ensilage almost as well as the best. It is hardly safe for us to say that because the ensilage seems rank and bad to us that therefore it is not good food for them. Of course the more acid there is the more loss there has been, for the acid is a product of the destruction of good feeding material, and although that acid ensilage may be fed, yet you cannot afford to have it change into that condition if you can get it in some other shape. The so-called sweet ensilage, though not really sweet, is that which has been slightly fermented so as to give but a little taste of acid.

Now in considering the comparative value of corn fodder and ensilage we take up a part of the subject that has been discussed with quite a good deal of feeling. There is a loss in feeding value in whichever of the two ways you use in curing the corn. If the corn fodder has been under the best conditions, has been housed carefully, and protected from storms, there will still be a loss, and this loss is a good deal larger than farmers are apt to think. Under the best of conditions of drying corn fodder, and the best of conditions in the silo, there is probably not much difference in the loss under the two methods. But whereas one has under his own control the conditions in the silo, and can easily keep the losses down to nearly the lowest point, in the field he is at the mercy of the elements, and the chances are that the corn fodder dried will have more loss than it would put into the silo. The silo enables you to be your own master. In regard to the time of harvesting you can fill the silo without much regard to the elements, but if you are going to dry your corn fodder you are at the mercy of whatever weather comes at the time of cutting and hauling. Much of the feeding value in the corn stalk is soluble in water, and a heavy washing of rain soon after the stalk is cut will wash out much of the feeding value.

When corn fodder is put into the silo the loss falls more on the heat producing than on the muscle producing elements. In the ensilage the proportion of the parts is not the same as in the dry fodder. It is a better proportion because we want to get as large a proportion as possible of the muscle producing to the heat producing elements. When that fact was first noticed that ensilage had a larger proportion of muscle producing elements to the heat producing it was thought that the ensilage had actually increased in digestibility, and had in that way been made more valuable. But we know now that the loss falls unequally and the starch or sugar is more acted upon than the albumenous matter, the muscle producing, so that the ensilage has a better feeding ratio than the corn fodder dried by the ordinary methods.

The dry matter of the corn fodder is of about the same feeding value of hay, that is, a pound of perfectly dry corn fodder is just about the same as the perfectly dry hay in feeding value. As between corn fodder and ensilage we find that in actual farm feeding the en-

silage gives better results than the same weight of corn fodder used in a dry form for producing milk or butter. If both ensilage and corn fodder have been preserved in their best possible form the difference is not great. The corn fodder air dried usually gives a smaller feeding value than you would expect from its chemical analysis, while the ensilage usually gives better results. Two reasons may be given to explain this. The fact is certain, that whether or not the cow relishes her food has quite an influence on the result that she will give at the milk pail from that food. If you force a cow to eat food that she does not like, she is going to show the effect decidedly in the change of milk, while anything she does like has a tendency to produce an extra flow of milk. This is why we get such good results from ensilage, for there is hardly anything that you can feed to a cow that she likes so well. The palatability of the food and the health of the animal have much effect upon milk flow, and to its succulency is probably due a part of the success obtained by feeding ensilage.

HOW SHOULD THIS ENSILAGE OR CORN FODDER BE FED?

It should always be remembered that corn in all its forms is a one-sided feed, and needs grain to balance it up and make it a complete ration. This grain should not be corn meal; that is a mistake made by many farmers. They find corn ensilage to be one-sided and to make it up they feed corn meal. Both these foods have too small a proportion of the muscle producing elements, and we need to add to them some of the concentrated foods, bran, oil meal, gluten, cotton seed, or something which is going to balance them. In feeding ensilage it is better to make only a part of the ration of coarse fodder. Part of the corn fodder can be put into the silo, and part dried fodder, and then the ration of coarse fodder can be made to consist of a mixture of ensilage, dry corn fodder and hay, putting whatever grain you feed right into this mixture, feeding only twice a day. Our farmers should always keep in mind the distinction between the raising and feeding of corn from our own farms and the paying and using of western corn. The corn plant is next after hay the cheapest source of actual fodder, provided we raise it on our own farms and feed what we raise. You get then the full feeding value of the stalks. You can raise the corn yourself as cheap as you can buy western corn, and have besides the feeding value of the stalks, which is so much clear gain.

DAIRYING IN VERMONT.

BY ROLLIN C. SMITH, OF PITTSFORD, MEMBER OF THE BOARD OF AGRICULTURE.

Dairying is the leading industry of the State, and at the last census we had over three hundred thousand cows. While this is one of the oldest industries known to agriculture, it is, taken as a whole, only about a quarter of a century old. Thirty years ago Vermont was a sheep raising and wool growing State, and as such was a success. I very much doubt if Vermont agriculture will ever be in a more prosperous condition than when we were raising sheep for the western market and selling our wool for forty cents and over. We were a perfect success in producing the typical merino. We imported sheep from Spain, and with a few years of judicious breeding took the progeny of those sheep back to the old world, and in competition with the whole world won the first prize over all competitors. Vermont soil, Vermont climate, and the Yankee skill combined can grow the most perfect sheep to be found in the world. With the low price of wool and no demand west, our State was compelled, very reluctantly, to abandon this industry and embark in the dairy.

It is proverbial among ourselves, as well as in other States, that for rushing into a business where a few men have made a profit Vermont will beat the world; and Vermont literally made a rush into the dairy. Cows were picked up with very little knowledge, and much less thought; bought wherever they could be found; bought out of droves being driven to Massachusetts and Connecticut; bought without knowing anything about whether they sprung from good milking stock or not; bought if they were only cows and would give milk. Forty, fifty and even a hundred dollars was paid for cows. Perhaps under the circumstances this was as well as could be done, but this was not the worst part of it, for a very large majority of the dairymen have bred just as they bought, bred to anything that came most handy, by any kind of a bull, not particularly because it was a saving of money, but because they were thus careless and not thoughtful on the subject. The average yield of cows in the State is much less than it should be. In milk the average is about 3,250 pounds and the yield of butter per cow is less than 130 pounds per annum. It will be seen by these figures that the general dairy will not be very remunerative. Individual dairies give a yield of 7,000 pounds of milk yearly, and individual cows much more than that. Individual dairies give a

yield of over 300 pounds per cow, and there are quite a number of this class. This goes to show that, as a whole, we have too many poor cows, too large a per cent. that do not pay their keeping. That the business itself is remunerative is plain to be seen, or it would not support so many inferior animals.

The difference in value between a good cow and a poor one is not often taken into consideration by the buyer and seller. Cows range in price to-day from $30 to $50. Now a cow that can produce 300 pounds of butter yearly is worth for that purpose more than double the price of a 150 pound cow, for she requires no more care, eats in many instances no more, and produces as much again. This is an item too often overlooked among dairymen.

It may be a broad assertion to make, but I think if one-fourth the cows in the State had been annihilated last fall and the value of their feed given to the remaining three-fourths, the gross products of our dairies would have been increased.

Now, where is the remedy? It is breeding, raising and care of the stock, assuming of course that the milk product is rightly managed.

BREEDING.

If a farmer who has twenty cows of no particular breed wishes to raise from them an improved dairy, let him test those cows so he will *know* which are the poor ones and throw them out, discarding, say, one-fourth of his breed. Then secure a stock animal of the breed he wishes to grade up. This is one of the unfortunate features in breeding dairy stock. We seldom know what the stock of a bull will be; nine times out of ten they are untried animals. Stock horses are nearly always kept long enough to know something of the value of their progeny, but bulls seldom live till their first crop of heifers come into milk. For this reason we want to know his breeding, want to know that he springs from a good race of milkers; and the more generations he can be traced back, the more valuable he will be likely to prove. He should also be a pedigreed animal; the better his breeding, the more thoroughbred he is, the more he will transmit the peculiar qualities of his family to his progeny. For the next cross some breeders would use the same sire on his own progeny; for this practice I am unable to advise, although most of the cows that have produced remarkable butter records have been very strongly inbred animals; but I would advise breeding from the same family; breed the heifers, if they were strong and rugged, to a half-brother of their sire. They would be more apt to transmit the good qualities of the family than if not so closely related, while any defect would also crop out in same proportions. Never cross breeds. If you have selected Ayrshires, breed them sa nearly pure as you can, and breed for the characteristics of the breed, not one year breed one kind and another year something else. If you are breeding for market have your cows as nearly alike in color, size, etc., as possible. Breeding in this manner will always improve the herd. One of the most successful

dairymen in the State, who had improved his herd from 130 to 300 pounds per cow, said he was going still higher—not by feeding but by breeding.

REARING.

It is an undisputed fact that animals intended for different purposes require different treatment while young. For example, a colt intended for a trotter needs the fullest development of his muscles; he must needs be exercised, and fed on fodder that will increase physical force. No one would think of shutting him up and feeding him corn and other feed to produce fat. Neither is it policy to over feed a calf intended for a cow; give plenty of exercise, grow as regularly as possible, have them in a pasture, if in summer, where they will learn to feed, and feed skim milk till at least five months old. Never try to grow a yearling in six months, but be 365 days about it. We want our young cows fully developed in all their parts, as in traveling over our poor pastures (any it is a lamentable fact that they are growing poorer every year) thed need to have good limbs as well as well developed udders. Let there be no pampered animal in a dairy, but one brought up to work for her feed. More calves are injured by over-feeding before four weeks old than by not having enough food.

I prefer calves to be wintered in a shed, running loose the first winter. A dry place to lie, with what good hay they will eat, will cause them to grow well through the winter. If spring calves well raised through the summer will not make good growth on this kind of feed and care, they are of no breed the average Vermont farmer wants to keep. The second winter they should be stanchioned. The more accustomed they are to being handled, the easier they will break to milk. A finely bred heifer of any of the milking breeds is a nervous animal. Any animal bred generation after generation for a special purpose will be nervous, and the kind, judicious handling she receives while young helps, in a measure, to overcome this. Feed them during the winter to make them grow. Cattle of this age on the average farm are put on to the poorer fodder; this is a necessity in many instances, and may be modified in a great measure by care. Feed alone is not by any means the sole element; regularity, warm and dry quarters, and to this add kindness—all are essential, and either one left out impairs the value of the rest. I would have them carded, not as a matter of fancy, but, if for no other reason, to accustom them to being handled. If your heifers are all tame and can be approached in the yard, they will make much more docile and manageable cows. No cow should fear the owner or attendant if you wish to get good results from them, and the younger they are taught this the better. I do not recommend feeding grain if they can be kept in a thriving condition on hay and coarse fodder. An overgrown cow is, generally speaking, out of proportion in a common dairy. Raise as near as possible to a uniform size, as well as color.

CARE OF COWS.

This is the most important feature of all. Any cow, never so well bred or reared, without proper treatment will not reach the highest degrees of her usefulness. Regularity in feeding, milking, watering, etc., will show in the product, and the reverse will be as noticeable in a shrinkage. No cow can do her best that is uncomfortable, either by being in an uncomfortable stable or being worried in any way, and a cow thus kept may be expected to give a decrease in the milk, and where the quantity is diminished the quality is also apt to be impaired. These are all items of more importance than the average dairymen are apt to credit to them.

REST.

A cow that is doing her best has a strain on her physical system more severe than the horse that draws the plow or the man that follows it. A cow that travels one of our Vermont pastures and is fortunate enough to gather enough forage to produce a heavy flow of milk does not need to be driven to another pasture or turned again into the same one for the night. For this reason I advocate letting them stay in their accustomed place in the stables every night in the year; there they can rest and not be disturbed, either by their mates or any other animals. It has been proved by many experiments that a cow can be over fed, and it is as necessary that they should have time to remasticate their food, so the system can utilize it, as it is that they should have the fodder in the first place.

In winter twice a day is the better way to feed any ruminating animal, either for growth, milk or beef. I can illustrate this no better than in the words of one of the most successful cattle feeders in the State. When asked how he managed about the feeding, care, etc., of his cattle, he said: "Feed in the morning a light foddering of hay; when this is eaten turn out and water; after that put back into the stable, feed grain and hay, shut up the barn and *keep away from them till four o'clock*, for after they have eaten they need the quiet and rest to remasticate and digest their food." Feeding at irregular hours is worse than fodder thrown away. Always salt regularly; the better way is to have salt kept by them the year around. Salt is required for a full digestion of the food.

WINTER VS. SUMMER DAIRYING.

The manner of conducting our dairies, to a great extent, is to have the cows drop their calves in the spring and go dry through the winter months. If the markets demanded the same kind of butter now that they did twenty-five years ago, that would be the most remunerative now, especially with our present cold storage system; but the market has changed, consumers now demand their butter just as near the churn as they can get it, and our highest-price butter is that fresh made; eighty-five per cent. of the butter made in the

United States is made in the summer months. The products of milk are unevenly divided. We should have more cheese made in summer; that article will keep, and bear transportation.

While much has been said in regard to poor quality of butter, and very justly, too, the cheese question will stand its portion of the criticism. New York and Vermont cheese does not have as desirable a reputation as it might. Some attribute it to the too free use of the skimmer, but very likely it is as much a lack of care and knowledge as anything. Good articles of either cheese or butter are always marketable, and command a good price. The correct idea in regard to placing these products on the market is to only make what butter is consumed, and the residue into cheese during the summer months, and make butter in winter as well as in summer. It is not every farm that is calculated for a winter dairy, nor every one that has suitable pasture for a summer dairy. Where the hay is good and properly harvested, making butter in winter is remunerative. The milk in winter is richer than in summer. All the extra cost is the feed in grain fed the cows. In summer dairying we get the greatest flow of milk from the 25th of May to the first of July. June is called the golden month for making butter. The product at this time is fine, but almost always prices are ruling low and the outlook is not encouraging. July and August are not good months for keeping, so customers buy sparingly. In July the feed begins to fail, milk begins to shorten in quantity and also in quality, and usually the price goes lower. As the feed begins to fail this month, some kind of fodder must be substituted; either green fodder, hay or grain must be fed, not particularly to increase the milk product, but to keep the cow in condition, for a cow poor in flesh cannot produce as much as she would in good condition. In August the fodder corn comes on and makes a good substitute for pasture; but this is a poor month for making butter, as is also the first half of September. On most farms the fall feed is ready to use about the 15th of September. Usually at this time the market begins to improve, and if in good fresh feed your cows will increase in their milk; that is, if they have not been allowed to get poor during July and August. If they are thin in flesh, you will get very little profit feeding them the fall feed. October is a good month for making butter; everything seems favorable if you have plenty of feed. If June is the golden month for making butter, October is the diamond month. If cows have not been stabled nights during the summer, they should be this month. A cow giving milk should never be allowed to get a chill. When they go to the barn for the winter, generally speaking, the cow that has been milked all summer has got through. She will hardly give milk enough to pay for extra grain any great length of time. And unless the hay is extra, she will soon dry off.

Now about a winter dairy. To get the most from a winter cow she should drop her calf about September 15th. This will enable her to get the run of the fall feed, and from that

time till she goes into winter quarters, she is at her best and the price of the product is always good and very liable to advance, while no one expects the price to advance in June or July. We get the largest product from the cow with no expense except the fall feed. When she goes to the barn comes the first expense, and the first and most important feed is to have good hay. You cannot feed a cow grain with profit if your hay is poor. On most of our Vermont farms the haymows are bottom upwards from what they should be, unless the dairyman is fortunate enough to have a crop of rowen. Early cut hay, well mixed with clover, oat or barley hay with ensilage or roots, and a well balanced feed of grain, will produce milk in paying quantities. Of course your barns must be warm, but no warmer than any humane farmer would want any stock to stand in. Good care, regularity of both feeding and milking, are essential. Don't overfeed or keep them in a yard for exercise when cold, as a cow giving milk needs very little exercise—some think the less the better—the conditions being very different with them than growing stock. If you can water in the barn, there are many days in winter when they are much better off not to be turned out at all. If very cold and the dairy large, would turn out only what would drink at a time, and put them in their stalls as soon as they drink. Never let a milch cow shiver. It will abundantly pay to study the comfort of your animals, especially milch cows. Days when they are the most comfortable in the yards, that is the best place for them, but, generally speaking, the barn is more comfortable then the yard. Your winter cows, if they have been cared for as they should be, will be good cows when they go out to grass in the spring; they will respond quickly to the first green feed, and up to the first of July are paying cows. Dry them off the first of July if they are to come in in September. I prefer in a large dairy to have them go dry two months; so dry them off the first of haying, and if you have a back pasture turn them away, and have your rest from dairy work come at a time when your time is the most valuable of any season of the year. The rest a cow gets in the summer is better for her than the same length of time in winter, and they will be in the finest condition the first of September, with only the cost of liberal pasture feed. So I advise taking into consideration the value of your time engaged in the work, the ready market your product gets, with the extra price above the summer market, the better condition your cows are generally in, a better season of the year to sell your surplus cows for more of the butter makers, and to adopt the winter instead of the summer time to make your butter.

CHEESE.

The same may be said of this article as a prominent speaker on butter making said of butter, i. e., you will not be liable to lower the price if you improve the product. First-class full-milk cheese

always commands a paying price. Our reputation has been injured by producing an inferior article. Our make of cheese does not command so good a price as the Canadian does in foreign markets. The skimmer has injured our reputation in dollars and cents much more than the value of the cream it took off. We may be too ambitious to make a pound of cheese from too small a number of pounds of milk; that may have as much to do with it as the skimmer has, but we should make a good article, and the most of our milk from the summer dairies should be used for that purpose. The better the article, the more will be consumed, and as it can be kept through the winter and sold at profit at any time, it pays much better than making butter for cold storage. The trouble with our dairy industry lies not so much in over-production as in the division of the product, viz. Butter and Cheese. Keep the supply of butter nearer the weekly demand. One week last August there was shipped to, and put upon the market in New York city, just four times as much as the market demanded. Three-fourths of that had to go into cold storage, and this was no very unusual thing to happen. The quotations March 1st for such butter were about 14 cents, while No. 1 cheese was quoted at 11 cents; so much difference in the favor of cheese. The prices paid for milk the past season at the factories have been about 25 per cent. higher in cheese than butter factories.

CREAMERIES.

Shall we make our butter at home or at a factory? It is a noticeable fact that all manufactories tend towards a center. The more goods of any kind made at a place, the cheaper they can be produced. This is one point to be considered; another is to relieve the help on the farm, the labor and care connected with the work; and still another very important feature is the quality of the product. We will leave the reader to apply the two first clauses as may best suit his situation and turn our attention more especially to the third. In any community where there are, say fifty or more, families making butter, you are making about as many different grades of butter and it is bringing about as many different prices. Farm dairies will be very apt not to have as good facilities for making and handling the product as can be found at a first-class creamery. Neither can the farmer afford to give the milk, cream, etc., so much attention as the man who manages the creamery. It is very true there are some private dairies that are making a first-class article and getting a first-class price for it; but, taken as a whole, the creameries are taking the lead in price. In the first place, they can, or at least should, get all the cream from the milk, which very few of the private dairies do; then again, they make a uniformity of product, which always adds to the market value. If fifty are patronizing the factory, instead of having so many different kinds of butter

there is only one, and if the factory receives its milk or cream in first-class condition there is no reason why the butter should not be as good as the best that can be made in the neighborhood. There is also a chance to obtain more per pound. A man who handles a large quantity can secure a butter market; he can afford to spend time in looking up a good market, which the farmer who makes but a hundred pounds or such a matter per week could not afford to do. With the cream gathering systems, the farmer is credited with the number of spaces of cream, and in the whole milk factories by other means of testing. There may be much improvement yet on both of these systems, but each has proved satisfactory in nearly every instance where they have been in operation. The testing of the milk at factories has been one of the embarassing features, and no very definite system has been agreed upon; and it is hoped that some reliable way may be found out soon. One great difficulty exists among the patrons of the creameries, that is, they do not know what their milk is worth, at home. If they would carefully weigh their milk and weigh their butter after it was prepared for the market, they would know then what it was worth to them, where in nine cases out of ten it is simply guesswork, since in one herd may often be found some cows making three and some six pounds of butter from a hundred pounds of milk.

VERMONT HORSES.

BY C. M. WINSLOW, MEMBER OF THE BOARD OF AGRICULTURE.

The highest success in any branch of stock-breeding depends largely on the selection of foundation stock. If this, either by force of circumstances or far-seeing wisdom, is chosen in conformity with the natural requirements of food supply, soil and climate, the success in growth of stock is made certain; and if, in addition to all this, such stock as naturally supplies the needs of the inhabitants is selected, its popularity is at once insured, and financial success made certain. No well regulated method influenced the early settlers in the choice of mares to draw their household goods and families from the older settlements of Massachusetts, Connecticut and New York, as they moved into the newer wilderness of Vermont; and it was an accident that led Justin Morgan to bring into the State a horse that was destined to produce from the native mares of the State, a family of horses that has made Vermont famous the world over.

About one hundred years ago, Justin Morgan moved from Springfield, Mass., to Randolph, Vt., taking with him a small, two-year old colt, that was afterwards named from his owner, Justin Morgan. He was said to have been sired by True Briton, a horse stolen from the British General, DeLancey, at Hartford, Conn., during the Revolutionary war. True Briton was by Imported Traveler, he by Morton's Traveler, a horse that while called an English thoroughbred, was, in fact, an inbred Arabian. Linsley, in his history of the Morgan horse, describes Justin Morgan as follows:

"The original, or Justin Morgan, was about 14 hands high, and weighed about 950 pounds. His color was dark bay, with black legs, mane and tail. He had no white hairs on him. His mane and tail were coarse and heavy, but not so massive as has sometimes been described; the hair of both was straight, and not inclined to curl. His head was good, not extremely small, but lean and bony, the face straight, forehead broad, ears small, and very fine, but set rather wide apart. His eyes were medium size, very dark and prominent, with a spirited but pleasant expression, and showed no white round the edge of the lid. His nostrils were very large, the muzzle small, and the lips close and firm. His back and legs were perhaps his most noticeable points. The former was very short, the shoulder-blades and hip bones being very long and oblique, and the loins exceedingly broad and muscular. His body was rather long, round and deep, close ribbed

up; chest deep and wide, with the breast-bone projecting a good deal in front. His legs were short, close-jointed, thin, but very wide, hard and free from meat, with muscles that were remarkably large for a horse of his size, and this superabundance of muscle exhibited itself at every step. His hair was short, and at almost all seasons soft and glossy. He had a little long hair about the fetlocks, and for two or three inches above the fetlock on the back side of the legs; the rest of the limbs was entirely free from it. His feet were small, but well shaped, and he was in every respect perfectly sound and free from any sort of blemish. He was a very fast walker. In trotting his gait was low and smooth, and his step short and nervous; he was not what in these days would be called fast, and we think it doubtful if he could trot a mile much, if any, within four minutes, though it is claimed by many that he could trot it in three."

This horse was used on the native mares of the State for many years, and sired a class of horses that were admirably adapted to the general purpose work required by the inhabitants of a mountain State of small farms. The farmers required a horse that could do some plowing and teaming; that could take a heavy load up hill and down for long distances; that was sure-footed, and of a pleasant disposition; easily kept, and of strong constitution. All this, Justin Morgan inherited from his Arabian ancestry, and from his intense Arabian breeding was able to impress those sterling qualities on the mixed class of mares found in the State. There are a number of families of sturdy Morgans tracing to the old horse, but perhaps the most famous family is the Lambert, tracing back through Ethan Allen, Vermont Black Hawk, and Sherman Morgan to Justin Morgan. This family seem to have developed a larger size and more speed, as a rule, and are sought for as driving and carriage horses, being usually of good size, good disposition, and stylish. Also this family of horses are desired as brood mares in all sections of the country, as a foundation for a cross with the Hambletonian family, the strong constitution, good disposition, and extra road qualities of the Morgan mares, making them, when crossed with the fast trotting lines of other families, liable to go very fast, and desirable as trotters. Whether it is advisable for farmers of Vermont to engage in horse raising as a business, is a question; but one or two good mares on a farm may be kept with no great extra expense, and if good judgment and care is taken in the selection of the mares, and if they are bred properly, no small revenue may be expected. The selection of the brood mare is all important, and a few dollars extra, paid to secure a good mare, is money well spent, for the extra is divided between many colts, and a good mare is liable, in the extra price of one colt, to pay many times over the extra paid to secure a good mare at the start. In selecting a brood mare for the starting of a family, great care should be taken to secure a mare of good size, not less than 15 hands high, while 15-2 or 3 would be better, to weigh not less than 1,000 pounds, of good natural style and pleasant disposition,

sound, and with a strong constitution. Then, too, she should have a large amount of nervous energy, controlled by an intelligent brain power. All this she should be in herself; then back of her she should have as long a line as possible of this class of horses. If, in addition to all the above, the mare has speed in herself and ancestry, so much the better. In selecting a horse to couple with such a mare, it would be better to choose one of similar qualities, somewhat larger than the mare, though not over 16 hands, or 1,200 pounds; a horse with a large amount of natural energy and power, but perfectly kind and level-headed. If there are any defects in the mare, care should be taken not to choose a horse having the same, for you will be almost certain to reproduce them in the colt. The care of the mare while carrying the foal is often overlooked; nevertheless, of great importance. She should not be fed fattening food, but should have an abundance of nourishing food, such as contains a large percentage of bone and muscle-producing qualities. She should have exercise, either by a run in a large yard, or very moderate driving. It is difficult to produce a strong, courageous colt from a mare overworked or half fed during pregnancy. As soon as the mare is taken off the pasture and fed with hay in the fall, she should begin to have a daily feed of wheat bran to prevent a liability of losing her colt. As soon as the colt is dropped, care should be taken to give it a continued and steady growth, and its training should begin very early in its life, getting it accustomed to being handled, and led by a halter. The early growth and the early training are what determine the future of the horse. A critical time in the life of a colt is at weaning time,—which should be at about five months,—at which time he should have been taught to eat oats or bran, and when weaned should have a liberal allowance, giving him all he will eat for a week or so, until he ceases to mourn for the dam. An excellent food for colts just weaned is sweet skimmed milk, warmed to the natural temperature. If offered to them about twelve hours after being taken from the dam, they will usually take a little, and will soon learn to drink readily. Skim-milk, if sweet, is better than new milk, because more like the milk of the mare, not having any cream. As the raising of horses is for the purpose of obtaining money, the colt should be for sale any time, and when a fair price is offered, the colt should be sold; but the owner should take pains to find out the quality of his colt, prospectively—which he can usually do by watching him at his play while following the dam;—but he should be very careful not to think he has a wonderful colt, that may sometime make his fortune, for if he does he is very likely to price him too high to make a sale, and if he is supposed to have a promising colt that is well gaited, he is in great danger of making a serious mistake in placing him in the hands of a trainer, to develop. If he does this, he will usually find no end of expense, and final mortification and loss of money.

The farmer should be a breeder, and sell to others to train. In this way he will avoid the great expense and risk, and can make a

fair profit for the keeping, consuming the fodder on his farm. If his mare prove a good stock getter, and his colts do well, they will sell readily, and at high prices, as the older ones gain reputation. There is always a market for a young horse of good size and style, and the faster he can trot, the higher the price; but it is not safe to breed for speed alone, for the per cent. of very fast horses is small, and if they are too small and cannot trot, they will not pay the expense of raising; but if they are of good size and disposition, with style, and a fair amount of speed, they will always sell for a profit, as gentleman's drivers.

This class of horses, by doing the work of the farm, may be made to pay the cost of keeping until sold, and in this way be a source of profit to the farmer.

BUTTER-MAKING.

BY W. W. COOKE, MEMBER OF THE BOARD OF AGRICULTURE.

The subject of "perfect butter" covers a rather wide field; for the manufacture of perfect butter requires perfection in several other things besides the butter itself. A certain necessary outfit is required for the manufacture of perfect butter, and this outfit consists of good cows, good feed, absolute cleanliness, and a good man. As to which of these is the most important, it is hard to decide, when all of them are necessary, and when the slightest lack in any will produce disastrous results.

Taking them in the order named, there might be a good deal of difference, in the judgment of different individuals, as to what should be called a good cow. One considers a good cow the animal that has produced a fair profit on the feed consumed. Another considers pedigree or breed. A definition of a good cow, in the sense we are now using the words, for the manufacture of perfect butter, might be thus stated: a good cow means one that gives healthy, good tasting milk, which contains the particular ingredients which we call flavor when it is found in the butter. The first of these, the giving of healthy, good-tasting milk, is common to almost all cows under proper conditions; in fact, it is the normal, natural condition of the cow to give good milk. The second, the containing of a desirable flavor in the milk, which will impart itself, and produce a high flavored butter, is, to quite an extent, an artificial and acquired quality of the cow; it is partly breed characteristic and partly individual. It is found more commonly in some breeds than in others, but is also found, in widely varying degrees, in different animals of the same breed. The Jersey and Guernsey are supposed to have it pre-eminently, and the Holstein breed also lays claim to it, but we find cows in all these breeds which lack it, and we find other cows of other breeds which have it to a very high degree. It is safe to lay down the general rule that we are more likely to find it in the breeds which are commonly called the butter breeds, than in those which are raised for milk or for beef, and that this quality is one of the particularly valuable qualities of those breeds.

The second necessity we have mentioned is good feed. This opens up a wide subject, and we could easily spend the whole time allowed us in discussing the question of the effect of feed on the quality of the product. But in this connection we will notice merely some of the more striking effects. The feed must be healthful, for the animal cannot give good results unless she is in

a healthy condition. It also stands to reason, that the food must not contain any disagreeable flavoring matter, which can find its way through the system of the animal into the milk and butter. You will notice that the system of the animal is put in, and that is a very important proviso. All feeds which contain badly flavored oils, especially the sulphur oils, are liable to taint the milk and butter through the medium of the animal itself, the sulphur oil passing directly into the milk. But those feeds which contain bad odors that are not in the nature of oils, very seldom give any bad flavor to the milk. Ensilage is probably as good an example as any. Here we have a substance which is pronounced to be not well flavored; it has decidedly a bad odor—that is, not all ensilage, but a good many samples, and yet the milk as drawn directly from the animal is destitute of any effect derived from this odor. The same is true of a large variety of bad smelling foods. But we must not forget that milk absorbs odors from the surrounding atmosphere very readily and quickly, and that milk allowed to stand a few minutes in a stable with a bad odor of ensilage will take up rapidly these odors, and the person who eats the butter made from it says that feeding ensilage to the cows has injured the taste of the butter.

You all remember the experiment of Dr. Sturtevant with brewers' grains, which, fed in the vilest possible forms, produced no objectionable effect on the milk or butter.

The question of what not to feed to produce perfect butter is much simpler than the important question of what to feed. Whether high flavor can be put into the butter by feeding, is still a mooted question. It certainly is a fact that the cows on the first green grass of the spring produce a more highly flavored butter than on the dry food in the winter. And it is strenuously held by many of our best feeders, that there are certain feeds which have the quality of imparting a desirable flavor to the butter. Among these may be mentioned clover-hay, ground oats, and corn meal.

The third necessary condition given, that of cleanliness, ought not to be needed to be mentioned, but as a fact is one of the commonest causes of failure to produce good butter. The trouble in most cases is, that the cleanliness is carried out through only part of the process, instead of the whole. Cleanliness should begin in the stables, by having the air fresh and sweet; having the floors clean and well bedded; having the cows well carded. It should also extend to perfect cleanliness in the act of milking, which, I am sorry to say, is a part that is neglected in probably nine-tenths of the stables. Cleanliness in straining, in washing the milk-cans, is not so commonly at fault; this is especially true of washing of milk-pails and pans. Many a farmer considers his duty of cleanliness as beginning and ending at that point of the process. It is much easier to keep milk from getting off flavor than it is to restore that flavor when once lost. And this applies to nothing more strongly than it does to the bad odors that get in from the lack of cleanliness. What difference does it make if the milk-pail is

clean, provided a large amount of dirt is gotten into the milk during the act of milking. Nothing that can be done to that milk thereafter will succeed in getting out all of the effect. Cleanliness must also be enforced during all subsequent handling of the milk, through the process of skimming and churning; this is especially true of the keeping it in a pure atmosphere, where it will not absorb bad odors. Cleanliness is, of course, required in churning and butter-working, and in most cases is found in the churn, but not so commonly in the butter-worker. Many a worker and butter-bowl has spoiled at the last stage butter that bad been carefully guarded up to that period.

Lastly, we have considered a good man as one of the necessary qualities of perfect butter. Intelligence is required in butter-making to make a good article, the same as in every other process. Good butter requires brains, and no one need expect to make a first-class article, and get a first-class price for it, unless he is willing to put intelligence and intelligent labor into the work.

So much for some of the conditions which are absolutely required in all cases. Coming now to part of the work which immediately concerns the making of "perfect butter," we will leave out of further consideration the care, feeding, and handling of the cows, and suppose that the milk, perfect in all respects, has been brought from the stable to the creamery. The next stage in the process is the extracting of the cream from that milk. No part of the entire farm work has been so thoroughly revolutionized in the last quarter of a century as the process of extracting cream from milk. For hundreds of years the milk had been treated in practically the same way, set in small pans or crocks, to the depth of two and a half, or, at the most, three inches, put away in a cool place, and allowed to stand until cream had risen, and the milk was more or less soured. There is not a doubt that as fine butter has been, and can be, produced by this method as by any other, and the reason for discarding was entirely on account of the labor of using it. Next in order after the small, shallow pan, came the large, shallow pan, or it is often called the Orange County pan, in which the temperature should be controlled somewhat by a current of water flowing under and around the containing vessel.

The next system brought out was a complete change. Up to this time milk had been set at about the same temperature at which it was to be churned—that is, from 60° to 65°. It was now proposed to set the milk in ice water, and cool it down as soon as possible. It was found that the cream rose more quickly when the warm milk was put in cool water, than when it was allowed to stand at a higher temperature, at 60° to 65°. It took from thirty-six to forty-eight hours for the cream to rise through a distance of two and a half to three inches; when the same milk was put into cool water, the cream would rise through a height of twenty inches in twenty-four hours. Hardly had this system been brought before the public before a still greater change was made, and a new machine, called the Centrifugal Separator, was invented, which

reduced the time for obtaining the cream from twenty-four hours, under the cool, deep setting, to but a few minutes. The whole tendency of the modern improvement in the creaming of milk, has been toward the shortening of the process, and the handling of the milk in less vessels, and in larger quantities, and with less labor.

Here, then, are several systems before the public for use. Which one shall the man take who wishes to produce perfect butter? As regards quantity, there seems to be little doubt that the separator, taken the whole year through, gets a larger quantity of butter from the milk than any other known system. Our Station has tested a good many creameries during the last two years, and we find that though there is little difference in the different methods as employed at the creameries in the middle of summer, yet whatever difference there is is in the favor of the separator, and in the fall and winter this advantage becomes greatly increased, and a much larger amount of butter is made from the separator with the same milk than by any other process.

As regards quality of butter from these different processes, I know of but one safe method of judging. If we take individual samples to the judgment of individual experts in the matter, we will find now one system taking the lead, and now another. But if we go into the general market, we find the butter from the separator, and the butter from the cold deep setting, standing on the same footing. The judgment of the large buyers of the country, not as expressed by the spoken word, but as expressed by the price they pay for the butter, says as plainly as can be said, that they consider the butter from the cold, deep setting, and the butter from the separator as of equal quality. This, to my mind, is the highest tribunal by whom this question can be decided, and it seems to have pretty effectually settled the question, whether the separator can make really first-class butter.

Incidentally here we might bring up the subject of actual quantity of butter produced by these different systems. A statement is made in the last annual report of the Wisconsin Experiment Station that ordinarily in private dairies, at least one-fourth of the butter in the original is lost in skim milk and buttermilk. In our tests of private dairies a few have run as low as this, but most of them have not lost more than one-fifth. Our tests of creameries show that on the average they lose only one-tenth. In our own work at the Experiment Station at the present time, we are using the separator, and though in the winter, and with what is commonly called heavy milk, that is, milk from which it is quite difficult to make the cream separate, yet we are losing not more than one twentieth. The whole subject of economical handling of milk to produce the largest amount is an exceedingly interesting and practical subject, but we will not spend any more time on it at present.

Having obtained the cream from some one or other first class method, the next step in the process is the ripening of the cream. Just

what is meant by ripening is something about which doctors disagree. By some it is claimed to be merely souring, or, speaking more accurately and chemically, the growth in the milk of the lactic ferment, and the production by it of lactic acid from the milk sugar. John Boyd is the firmest advocate of this system, and by means of suitable apparatus he manages to produce during his process of ripening nothing but lactic acid. I have had no experience with his method, and do not know persons, or the experience of others in the matter, and can only give his testimony that he found the flavor of the butter under this system to be very fine. In all other systems except John Boyd's the attempt has been to get a thorough action of the air on the cream. The general idea is that the process of ripening consists of something more than the mere acidifying, that is, in some way the flavor is heightened by the action of the air on the butter. Whether or not this is true, it certainly is a fact that some of those who are noted for their fine butter are particularly careful on this point. One of the best examples of this is the case of the butter that has just taken the gold medal for the best butter in the world, at the Paris Exposition. This butter was made at the Green Mountain Stock Farm, at West Randolph, Vt. One part of their method of manufacture is, that the cream is spread out in large shallow pans so as to expose as much surface as possible to the air, and is stirred every little while, so that during the process of souring there is a very large amount of action of the air upon it. They consider this one of the important parts in the manufacture of their butter. It has generally been supposed that to this action of the air is due some part of the fine quality of the butter that is made by the old-fashioned shallow pan. In this case the air has access to the milk during all the time that the cream is rising, and is standing spread out, so that the action of the air on the cream is more than by any other method, unless possibly that used by the Green Mountain Stock Farm. On the contrary, there are persons who prefer the taste of butter from sweet cream rather than from sour cream. This number is small, but is steadily increasing, and there is the general tendency in the market to use butter which is made from cream less sour than a few years ago. In fact, the market at the present time demands for the highest grade, a butter that is made from cream that is only just sour, and which contains quite a good deal of the creamy flavor. For most persons this is a flavor which is agreeable to them. There is another side of this subject of ripening or souring the cream. In regard to the quantity of butter obtained by churning that cream, it is a fact that at the same temperature, and under the same handling, there will be less loss in the buttermilk, that is, there will be more butter obtained when the cream is sour than when it is churned sweet. To produce the best results in churning, the cream should not only be sour, but every particle of it should be of the same degree of sourness. This is contrary to the custom of many dairies, especially the small dairies, where it is customary to mix cream of different ages just before

churning. When this is done there is always a loss. It has been found by repeated experiments, that cream mixed just before churning acts just as the two parts would if they had been churned separately, that is, if a certain sample of sweet cream when churned by itself would leave one per cent. of fat in the buttermilk, and a certain sample of sour cream would give one-half per cent. of fat in the butter milk, a sample of each of these of equal bulk when churned together would give a butter milk half way between the one per cent. and the one half per cent., or three-fourths of a per cent. It is a pretty good rule to mix the cream at least twenty-four hours before it is to be churned, letting the cream stand, with occasional stirrings, so that it shall all be of just the same ripeness. If properly handled and properly churned such a cream ought to leave no more than one-half per cent. of fat in the butter milk. The richness of the buttermilk is also influenced by the temperature in which the cream is churned. By reducing the temperature the amount of fat in the buttermilk is also reduced, and there is more butter produced, but this extra butter is produced at the expense of a longer time in churning. But if the churning is done by hand power, or if it is done in the summer when the temperature of the room is high, it may be more economical to churn at a somewhat higher temperature, even if the per cent. of fat in the buttermilk is somewhat increased thereby.

In ripening of cream there seems to be good reason for believing that a thorough action of the air is necessary for the best results. But a more important thing is that every part of the cream shall be equally ripened. In spite of the immense amount of time and labor that has been put on the question of what churning is, and why it is that the butter comes, we are still as much in the dark as ever. It seems to have been definitely decided that there is no envelope to the butter globules that has to be broken by the churning, but what change there is that takes place we do not yet know. Dr. Babcock calls it viscosity, but that is merely putting off the trouble one step further, and leaves us just as much in the dark as to how the churning overcomes this viscosity and allows the butter globules to come together. But this much we do know, that at a certain stage of the process all these globules that are in the same condition at that moment will unite, and those that have not yet reached that stage will stay ununited, and go off into the buttermilk. Hence it is necessary for the best results that we get all the butter globules in as nearly the same condition as possible, by doing which we lessen the amount of waste in the buttermilk. To do this the cream must be stirred occasionally, and all the cream that is going to be churned must be mixed together at least twenty-four hours before churning.

The size and the kind of churn also have something to do with the churning. A churn which has paddles in it, or which has any part of churn, in which the cream does not get as thoroughly churned as in some other parts, will give a large amount of fat in the buttermilk. The old-fashioned dash churn

seldom leaves less than one and a half to two per cent. of fat in the buttermilk, and it was not uncommon to have the buttermilk richer than the original milk. Whenever you find a person who has a ready sale for his buttermilk, or if the housewife always expects to use the buttermilk in cooking and likes it for such purposes, you may be sure that the person who does the churning either does not understand his business or has poor tools. In any of the revolving churns that churn by mere concussion instead of by some arrangement that shall strike the cream, the buttermilk ought to be so thin, that is, so lacking in butter fat, that it would be of no more use to the housewife than so much skim milk.

Temperature also plays an important part in the butter making as regards both the quality and the quantity of the product. The higher the temperature the more quickly the butter comes, and the less perfectly it comes, that is the more butter there is left in the buttermilk; and conversely, the lower the temperature, the longer times it takes to churn, and the more perfectly the butter comes. Some excellent work done by the New Hampshire Experiment Station showed that at the ordinary temperature of 60° to 62° sweet cream left a very large amount of butter fat in the buttermilk, and even sour cream did not churn very perfectly; but as the temperature was lowered better and better results were obtained, until at about 50° the buttermilk was nearly free of butter fat, about ninety-eight per cent. of the fat in the cream being obtained in the butter.

The quality of the butter is also influenced by temperature; the higher the temperature in which the butter comes the softer it will be, and the more difficult it is to handle it properly and get a good production out of it. And conversely, the lower the temperature, the easier it will be, and the better product will be gotten provided the butter is not chilled too much after it comes. It seems to be quite satisfactorily proved that butter that is churned at a low temperature stands up in hot weather a good deal better than if it were churned when it was warmer. There has been much discussion as to the effect of the method of obtaining the cream on the churning of that cream. Many have held that the cream from the cold, deep setting does not churn so well as that from different systems. Others have held the opposite. They claim that one of the special excellences of the cold, deep setting is that the cream churns very perfectly. The same statements on the two sides have been strongly urged in regard to the cream from the separator. It undoubtedly was a fact that when the separators first came into use few of those who run them got good results in churning, but that was not the fault of the separator, but was a result of a lack of knowledge on the part of those who handled them. I believe it to be a fact that the system for obtaining the cream has no necessary effect on the churning qualities of that cream, but that cream obtained by any of the methods ordinarily in use will churn and churn well, provided the butter maker understands his business. Of course it is a fact that the cream from

these different systems will have to be handled differently. The cream from the cold, deep setting is skimmed cool, and has to be warmed up in order to ripen properly. The cream comes out of the separator warm, and has to be cooled before it is set for ripening. One fact has been obtained in regard to handling the cream from the separator, especially in winter, that if the cream is first cooled down considerably below the temperature at which it is ordinarily set for ripening and then warmed up again, better results are obtained than if it is merely cooled from the temperature at which it came through the separator, to that at which it is set for ripening. We do not know the reason for this, though it is probable that the cooling destroys, or at least retards, the growth of the bacteria in the milk that hurtfully affect its ripening properly. We may take it, then, that the percentage of fat in the buttermilk will be a pretty fair estimate of the skill of the butter maker, or of the excellence of the tools he uses for churning.

The cream having been ripened properly, the next stage of process is the actual churning. As to the kind of churn to use, three things are to be considered. First the churn should not have any paddles, or anything of that nature to strike the cream, but the churning should be entirely done by the concussion of the cream itself. Secondly, the churn should be so shaped that all of the cream is equally acted upon, and thirdly it should be easy to clean and to clean properly, that is, it should have as few corners as possible, and they should be so shaped that they can readily be gotten into to be cleaned thoroughly. The box or the barrel form probably fulfill these conditions as perfectly as any; in fact either of those makes a perfect churn. Into this churn we wish to put the cream for churning. The churn must of course be scalded out first, and it is better to do this job thoroughly; first put in cold water, then boiling hot water, and then cold water again.

As has already been stated, the temperature of the cream is an important part of the process, and no one ought to expect to make a success of dairying unless they use a thermometer constantly. As to the proper temperature for churning, no set rule can be put down. It seems to be a fact that Jersey and Guernsey cream requires a higher temperature than the cream from the beef or milk breeds, or from grade stock. This difference amounts to nearly five degrees in the case of the best Jerseys. Sixty-two degrees is called the churning temperature, and if a person does not know by experience what temperature his particular cream requires, that is a good temperature to start out with. He may find that he may have to lower from this to get the best results, or in the cream of the best Jersey herds he will probably have to raise somewhat. The general rule will be to churn at the lowest temperature at which the butter can be obtained in a reasonable time; as to what this reasonable time is, opinions might differ. I do not like to have the butter come in less than thirty minutes and would rather it would be forty-five. Now that we are churning by steam power we lower the tempera-

ture until it takes about an hour. When we are churning by hand it took from thirty-five to forty-five minutes. Any one can learn by a few tests what temperature their cream will require to churn. It may be said in general that any churn that brings the butter quickly, that is, five, ten, or fifteen minutes, does not do thorough work. I have a churn which will bring butter from any kind of cream, or from whole milk in less than five minutes, but it is not an economical churn. A large part of the fat goes off into the buttermilk. In addition to the qualifications spoken of in regard to the churn, the churn should be of shape and condition that the butter can be obtained in granular form. This is really true of all kinds of churns, but it is easier and more certain to get it in some form of revolving churn than it is in any of the stationary churns.

The proper time for stopping the churn is the next stage in the process. At the present time most of the perfect butter put on the market has been washed into granular form, that is, the churning has been stopped as soon as the globules have bound together, until they make little grains of butter, the size of kernels of wheat. Butter makers differ as to what is the best size for these grains. Few would stop them when they are smaller than grains of wheat, and many continue to churn until the grains are as large as small peas. At the Bay State Fair this fall, among the samples of granular butter exhibited there, the average size was fully as large as small peas, and some of the samples were nearly twice as large. The object of stopping the churning at this stage, is to wash out the buttermilk as perfectly as possible; the smaller the grains are the more perfectly this can be done. But if they are much smaller than grains of wheat they will run out with the buttermilk and make a muss in straining them out. The churning should be continued long enough so that these grains will separate readily from the buttermilk and rise to the surface almost immediately, leaving the clear butter milk to be drawn off from under with but very little fuss in straining. It is sometimes advisable to add water and salt as soon as the cream breaks; this is especially true if the cream has been pretty thick when it was churned. The cream from the deep setting or the separator is usually thin enough so that the granules will form without any extra treatment. But if, for any reason, one has trouble with the cream in the separation it is usually advantageous to add either water or salt, or both. When salt is added it unites with the butter milk and seems to cut it, making a more perfect separation between the butter milk and the butter, and also making a brine, the specific gravity of which is considerably more than that of the butter fat, so that the butter rises more quickly and more thoroughly on top, and allows the buttermilk to be drawn off more completely and more easily, with less muss. The only objection to this is that it makes the buttermilk less valuable for feeding to hogs, that is, if enough salt is added to have the desired effect upon the butter, it makes it rather salt for stock feeding.

We have made several tests at the Station to see whether adding

water to the cream as soon as it breaks, that is, when the butter grains were exceedingly fine, had an effect of making the churning more thorough. The experiments were conducted in this way: as soon as the cream broke the churning was stopped, butter milk drawn off, and strained through a rather fine sieve, to stop the fine particles of butter; water was added and the churning was then continued until the butter had thoroughly granulated, and was just about to stick together into a large mass. Another sample of buttermilk was then taken. On correcting its analysis for the amount of water added, it has been found in every case that the results obtained were practically identical with that of the first sample of buttermilk, showing that when water is added it does not make any more of the globules of the butter fat go out of the buttermilk and stick together, so as to be saved in the butter, but merely allows those that they have separated to stick together more easily, and the buttermilk to be washed out more completely.

When the buttermilk has been drawn off the butter remains in small granules at the temperature that the cream was when the churning was stopped. If now at this temperature the churn were to be revolved the butter would at once mass together and hold in it whatever buttermilk still remained. What we have to do is to wash out this buttermilk without having the butter massed together. This can only be done by lowering the temperature to below 55° F, when these little butter grains can be worked, churned, handled in any way and not stick together. If we get below 55° they become so hard that they do not handle easily and make a poorer quality of butter. The desirable thing then is to lower the temperature as soon as the buttermilk is drawn off to about 55°. It is here that one of the advantages of adding water before the buttermilk is drawn off comes in. If after the cream is broken and just before it has finished granulating we can add cold water enough to reduce the temperature about half way from the churning temperature to 55°, the rest of the granulation will go on more slowly and is more perfectly under control, the churning can be stopped at whatever stage is desired and there will be less danger of the granules massing together when the buttermilk is drawn off. This is especially true in warm weather, when the temperature of the room is most likely to be considerably above the churning temperature, and when it is very likely there will be difficulty in cooling the cream down after the the butter milk is drawn off, without its gathering into a mass. After the buttermilk has been drawn off quite an amount of water should be added; the churn closed and allowed to stand for a few minutes until the butter has reached to nearly 55°. It should then be moved slightly, not violently, until the granules have separated by the action of the water, and become thoroughly mixed through the mass of the water, still retaining their granular form. After this has been done the churn may be agitated more violently, or even revolved without danger of the granules massing together. This wash water should be drawn off, and usually con-

tains enough butter milk to pay for saving it for feeding. At least two more wash waters should be added afterwards in the same way; keeping the temperature as nearly as possible at 55 °. If in summer, the last wash water may be as cold as the first, but if in winter and the churning is being done in a cool room it is well enough to have the last wash water a little warmer, so that the butter shall be a little above 55 degrees when taken out on to the worker.

In the working of the butter there are two ways now in use. Most people take out from the churn on to the worker, and get out some of the water before adding the salt, but some are beginning to add the salt in the churn. This brine salting of butter, as it is called, certainly makes a very fine quality of butter, better probably than can be made by handling the butter on the worker, but it is a little more work and requires a good deal more of salt and some more time. It is done as follows: After drawing off the last wash water, while the butter is still in the granular form, enough saturated cold brine is added, to a little more than cover the butter. This brine is made by adding to hot water more salt than it will dissolve, then stirring and allowing the brine to cool. After the wash water has been drawn off from granular butter and the butter has been allowed to drain for some time, it still contains more water, about one third of its weight is still water, that is, there is one-half as much water as butter, when the saturated brine is put into the churn. This water contained in the butter dilutes the brine and makes it considerably less than saturated. After standing for fifteen to twenty minutes the brine should be drawn off and more salt added, until it is again saturated; when this is returned to the churn it makes all of the liquid there so nearly saturated that the butter will take up from it about all the salt possible. It should be understood, of course, that the salt as it exists in butter, ready for the market, is not chemically combined with the butter fat, but exists as a solution of salt, or a true brine held mechanically between the particles of butter. We may consider butter then as a mechanical mixture of butter fat and brine. If this brine is saturated with salt the butter then is as salt as possible. If we wish to have the butter still more salt, the extra salt cannot exist in solution, but will be as little grains of salt mixed in with the grains of butter, and will be noticed as a gritty feeling to the tongue when the butter is eaten. Few people like butter so salt as this. Brine salted butter, which has been fairly well worked so that the excess of brine has been taken out of it, contains from three to three and a half per cent. of butter, and this is about the average amount called for by the general public. This is about the general amount left in when butter is salted, an ounce to the pound, on the worker. In brine salting, after the second saturated solution of salt has been added there is no need of letting it stand any length of time for the salt to penetrate the butter, since, as was just said, that is something that salt cannot do. Butter fat is absolutely impervious to salt. If you had a strong solution of salt in a vessel and had the

orifice of the vessel covered with a layer of butter hardly thicker than a sheet of paper it would be sufficient to prevent the brine from going out, that is, the brine cannot enter the butter itself at all, but can only exist in the cracks between the butter grains. Some who practice brine salting do not work the butter at all, but take it out from the brine and put it down at once in a jar, still dripping wet and saturated with the brine, or at most, merely allow the brine to drain off, and then put in jars without washing. Such butter is very fine in taste, but will not keep. For immediate home consumption, that is, consumption within a week, or at the most ten days, it is all right, but it would not do to put on the general market, though I believe there is one stand in Boston where it is kept on sale in that condition and ladled out from the brine to the purchaser as desired.

The working of butter has a two-fold object, first the getting out of the superfluous water, and second, the packing together of the butter grains so as to exclude the air. The butter is washed for the purpose of getting out the buttermilk. If the washing was perfect, that is, if there was no trace of butter milk left, butter would keep indefinitely, but this perfect washing can never be accomplished, and the best of butter contains more or less of buttermilk. The amount should not be in a good quality of butter more than a half of one per cent., but even at that small amount there is an abundance to produce a change in the butter, if it is kept where the air can get free access to it.

Butter consists of two parts; most of it is a permanent fat, chemically very much the same as the fat of oleomargarine, but in addition to this there is a small amount of fat which is easily broken up, and it is this part of the fat which is acted upon by the buttermilk or casein, and the acids produced by its disintegration form the rancidity of old butter, and give it its disagreeable smell and taste. If then butter is to be kept for any length of time, not only must the buttermilk be very thoroughly washed out, but the butter must be compacted, so that the air can have as little action as possible on the small amount of buttermilk left in the butter. Only a few years ago the public taste preferred butter which had a strong flavor, that is, in which the first stage of decomposition started. The tendency for several years has been toward a liking for butter that was more and more nearly fresh, until at the present time those who are willing to pay the top price for butter, demand that the butter shall be fresh from the churn, without a trace of decomposition, and with no acid, old or strong flavor. Consequently the packing of butter in summer, for winter consumption, has very much decreased, and in its place we have the running of creameries through the winter to produce fresh butter, and the storing of butter made during the summer in refrigerators, at so low a temperature that change cannot take place. If it is ever desired to keep butter for a long time without any change, and without going to the expense of cold storage, it may be done perfectly by the use of saturated brine. Well made butter, well worked and covered, so

as to exclude the air perfectly by pure, cold, saturated brine will keep almost indefinitely, and come out with the aroma and taste of newly made butter.

In the working of butter two extremes are to be avoided. The first, of working not enough, by which the butter is apt to be streaky, and contain considerable water. And the other by overworking, by which the butter loses its granular, satiny look, and becomes solid, streaky and salvy looking. The object of the working is to get out the water and to get in the salt. Any way of working which shall do this with the least possible handling of the butter is the best, and the particular excellence of brine salting is that the salt is not worked into the butter, leaving the only working necessary, just enough to take out the excess of water.

The following rules will give an outline of what must be done to produce perfect butter.

There must be a man well qualified for his work, and willing to use his brains, as well as his hands, in his calling. There must be cows that yield good healthy milk, free from any taint or bad taste, and for the highest quality of butter, possessing a peculiar high flavor, which is largely an individual characteristic of the animal. The milk must not be allowed to absorb any bad odors at any stage in the process. Absolute cleanliness is necessary throughout the work. The cream may be obtained by any of the methods ordinarily in use, and the quality of the product has no necessary relation to the method employed. The cream should be allowed to become slightly acid before churning. It should be occasionally stirred, and if the cream is from different milkings or sources it should stand at least twenty-four hours after it is mixed. The churn used should have no floats, paddles or inside machinery, it should act alike on all parts of the cream, should be easy to clean, and should be of such shape as to secure the butter in granular form. The churning should be done at the lowest temperature at which the butter will come in a reasonable time. The lower the temperature the more and better butter will be made. The churning should be stopped when the butter granules are the size of grains of wheat, the buttermilk drawn off and the temperature lowered, so that throughout the washing the butter may remain in granular form. The butter should not contain more than one-half per cent. of casein or buttermilk, and the buttermilk should not contain more than one-half per cent. of butter fat; neither of these are dependent on the system used for raising the cream, and their amount is a measure of the skillfulness of the butter maker in handling the cream. Salt exists in the butter as a brine mixed mechanically with the butter grains. The salting may be done with brine in the churn or with dry salt on the worker. The latter way is easier and the former makes better butter. Care should be taken not to over work the butter; all working, more than just what is necessary to evenly distribute the salt and press out superfluous water, is worse than useless. Pack to suit customers, and market wherever you can get the highest price. Above all, remember that

dairying is a business, and requires for success just as much care and intelligence as any other business. We may call times hard and business dull, but there is always room at the top and a good price for perfect butter.

COMMERCIAL FERTILIZERS.

BY W. W. COOKE, MEMBER OF THE BOARD OF AGRICULTURE.

The State fertilizer law puts the inspection of fertilizers in the hands of the Director of the Experiment Station, and as that officer I am able to make the following statements in regard to the fertilizer trade for the year 1890.

In order that the analysis of a fertilizer may be of value, it must fairly represent the average composition of that fertilizer. Great care is necessary in drawing a sample for analysis, to get one that is a fair sample. In this State a sampling tube is used that takes a section or core out of the entire length of the package, and thus insures fair sampling. All the samples analyzed in 1890 were drawn by the director of the Experiment Station, either in person or by deputy, except those samples that are given as sampled by the manufacturers. These brands could not be found by the Station agents, and the samples were sent by the manufacturers according to law.

EXPLANATION OF TERMS.

The ingredients of commercial fertilizers, upon which both their agricultural and commercial values chiefly depend, are nitrogen, phosphoric acid, and potash. Besides these more valuable ingredients, sulphuric acid and lime are always present in superphosphates in considerable quantities, being a necessary accompaniment of phosphoric acid as it exist in all fertilizers.

Nitrogen is the most costly of the three important ingredients mentioned, and adds largely to the commercial value of all the fertilizers sold in Vermont. It is found in the wholesale markets in quite a variety of substances which are used to supply this ingredient to mixed fertilizers, but which are available for fertilizing purposes when purchased unmixed with anything else. *Organic Nitrogen* is the nitrogen of animal and vegetable tissues. The following materials furnish organic nitrogen to fertilizers: Dried blood, dried and ground fish, azotin and ammonite (prepared animal matter), fish scrap, meat scrap, cottonseed meal, castor pomace, horn, hair, wool, leather-waste, etc. These substances must decompose and the nitrogen become changed into compounds of *nitric acid and ammonia* before it is available to plants. There is, therefore, a great difference in the value of organic nitrogen as found in the above-named materials. Dried blood, for instance, decomposes in the soil rapidly, while horn, hair, wool and leather

scrap, decay very slowly, and the nitrogen which they contain becomes useful only after a long period of time. These latter substances are not only less useful to the farmer than blood, fish and meat, but they are also much less costly, and their presence in a fertilizer supposed to be manufactured of the best materials is good evidence of fraud. Compounds of ammonia and nitric acid also occur in commerce, the former in sulphate of ammonia, the latter in nitrate of soda. Seventeen parts of ammonia, or sixty-six parts of pure sulphate of ammonia, or eighty-five parts of pure nitrate of soda, each contain fourteen parts of nitrogen.

The *phosphoric acid* of superphosphates is determined in three forms according to its solubility in various liquids, viz. *Soluble, reverted, and insoluble.*

Soluble phosphoric acid is that which exists in fertilizers in a form freely soluble in water. It is obtained by treating certain phosphatic materials, such as bone and South Carolina rock, with sulphuric acid (oil of vitriol). The advantage of having the phosphoric acid of fertilizers rendered soluble, is not that it remains so in the soil, for it becomes insoluble in water very shortly after application, but in the fact that when the compounds of the soil change it back to insoluble forms it becomes deposited in particles so minute that they are easily appropriated by the roots of plants.

Reverted phosphoric acid is a term that originally signified phosphoric acid that had once been "soluble," but which from some cause had "reverted," or "gone back" to forms insoluble in water. Now it is used to designate that which is dissolved by a solution of ammonium citrate, and includes not only the truly reverted, but also more or less of phosphoric acid as combined in the original, undissolved phosphate material. Reverted phosphoric acid, in so far as it comes within the strict meaning of the term, most probably has a value for crop production, equal to that of the soluble form, but it is not clear that this holds true of that which would be dissolved by ammonium citrate, from finely ground South Carolina rock, for instance.

Insoluble phosphoric acid is that which is readily soluble neither in water nor in a solution of ammonium citrate, but which can be dissolved in strong acids. In some cases the phosphoric acid is too insoluble to be readily available as plant food. This is especially true of Canada apatite. Bone black, bone ash, South Carolina rock and Navassa phosphate, when in coarse powder are commonly of little repute as fertilizers, though good results are occasionally reported from their use. When finely pulverized ("floats") they more often act well, especially in connection with abundance of decaying vegetable matters. The phosphate of raw bones is nearly insoluble, because of the animal matter of the bones which envelopes it; but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form.

It should be remembered that the terms "soluble," "reverted," and "insoluble," are merely relative in their significance. There is no compound of phosphoric acid that is not dissolved to a slight

extent, at least, in pure water, and to a still greater degree by ammonium citrate, and the extent of the solubility of raw phosphate in these liquids, and in weak acids such as are found in the roots of plants, depends very largely upon their mechanical condition, or the degree of fineness to which they are ground.

The *potash* used in this country for agricultural purposes, comes mostly from Germany in the so-called "German potash salts," which include sulphate of potash, muriate of potash (potassium chloride) and kainite. Except for a few special purposes, potash is equally valuable in all these forms, but costs least in the muriate and in kainite.

In their raw or unmixed state, little use is made in Vermont of the various materials of which complete commercial fertilizers are compounded. These materials, such as dried blood, fish scrap, ground bone, bone black, South Carolina rock, muriate of potash and kainite, are not required by the fertilizer law to be licensed or analyzed.

THE VALUATION OF FERTILIZERS.

A schedule of trade values is given to the fertilizers analyzed. By means of these trade values there is calculated for each brand what has been designated as the "estimated value" or the "station valuation." As these estimated values are not intended to represent the proper selling prices of mixed goods at the point of consumption, and in order to prevent any possible misapprehension as to their real meaning, the following explanations are offered:

1. These trade values represent very closely the prices at which a pound of nitrogen, phosphoric acid and potash, in their various forms, can now be purchased at retail in our large markets. They are based mostly upon the ton prices at which certain classes of goods are offered to actual consumers, and correspond also to "the average wholesale prices for the six months ending March 1st, plus about twenty per cent. in the case of these goods for which we have wholesale quotations."

2. These trade values do not include the charges for transportation from the market to the consumer, for storage, mixing, commissions to agents and dealers, selling on long credit, bad debts, etc., etc.

3. They are the prices of nitrogen, phosphoric acid and potash, *ready for use by the farmer*, when these ingredients are purchased under the above named conditions, singly and not mixed. In ordinary superphosphates we find these three ingredients mixed, but this is not a necessary condition of their use.

An illustration may serve to make clear the above statements. A farmer wishes a ton of fertilizer similar to the well-known brands sold in this State. If he purchases for cash in New York or Boston sixteen hundred (1600) pounds of dissolved bone black, three hundred (300) pounds of sulphate of ammonia, and one hundred (100) pounds of muriate of potash, and mixes these ingredi-

ents together, he will have a complete fertilizer not essentially different from many standard brands of ammoniated superphosphates. The cost of the ton after mixing (if the farmer prefers to mix the ingredients) will be made up as follows:

(*a*). Cost of the materials in the markets.

(*b*). Cost of transportation.

(*c*). Cost of mixing.

The first element entering into the total cost is the only one included in the "estimated value." If there is added to this one element, not only the charges for transportation and mixing, but also the expenses of selling through agents and dealers, long credits, bad debts, etc., we have the factors involved in the cost of our ordinary superphosphates, when delivered at or near the place of consumption. As is to be expected, the Station valuations of superphosphates fall below their selling prices. In 1890, the average difference in Vermont was $6.69 per ton.

4. The Station valuations stand in no direct or necessary relation to the comparative profits which may be derived from the use of the various fertilizers by individual farmers. These values have an almost purely commercial significance, and are not designed to point out to the farmer whether he shall use potash, which is a comparatively cheap ingredient, or nitrogen, which is comparatively costly. If ordinary superphosphates are compared, however, on the basis of commercial valuations, it will be found to be true in general that their fertilizing power is in proportion to their money value.

The following schedule of trade values to be used in this State, in 1890, is the one agreed upon by the experiment stations of Massachusetts, Connecticut and New Jersey, after a careful study of prices ruling in the large markets of New England and the Middle States:

TRADE VALUES OF FERTILIZING INGREDIENTS IN RAW MATERIALS AND CHEMICALS FOR 1890.

	1889.	1890.
	cts. per lb.	cts. per lb.
Nitrogen in ammonia salts	19	17
" in nitrates	17	14½
Organic nitrogen in dried and fine ground fish, blood and meat	19	17
" " in cotton seed and castor pomace	15	15
" " in fine ground bone and tankage	16½	16½
" " in fine medinm " " "	13	13
" " in medium " " "	10½	10½
" " in coarse " " "	8½	8½
" " in horn shavings, hair and fish scrap	8	8
Phosphoric acid soluble in water	8	8

Phosphoric acid soluble in ammonium citrate*....	7½	7½
" " " in dry fine ground fish and in fine bone and tankage.	7	7
" " " in fine medium bone and tankage.....	6	6
" " " in medium bone and tankage.....	5	5
" " " in coarse bone and tankage	4	4
" " " in fine ground rock phosphate.....	2	2
Potash as high grade sulphate.....	6	6
" " kainite.....	4½	4½
" " muriate.....	4½	4½

TRADE VALUES OF SUPERPHOSPHATES AND MIXED GOODS.

The above trade values are the average figures at which in the six months preceding March 1st, 1890, the respective ingredients could be bought at retail for cash in the larger markets, in the *raw materials*, unmixed. They also correspond to the average wholesale prices for the six months ending March 1st, plus about 20 per cent. in the case of goods for which we have wholesale quotations. The valuations obtained by the use of the above figures will be found to agree fairly with the reasonable retail price at the large markets of standard raw materials such as:—

SULPHATE OF AMMONIA,	AZOTIN,
NITRATE OF SODA,	DRY GROUND FISH,
MURIATE OF POTASH,	AMMONITE,
SULPHATE OF POTASH,	CASTOR POMACE,
DRIED BLOOD,	BONE AND TANKAGE,
PLAIN SUPERPHOSPHATE,	GROUND SOUTH CAROLINA ROCK.

The trade values are applied to the valuation of Superphosphates and all mixed goods as follows:

It is assumed that the *nitrogen* of these goods has for its source such materials as ammonia salts, nitrates, dried blood, ground fish, or nitrogenous substances of equally good quality, and it is valued at 17 cents a pound.

The *insoluble phosphoric* acid of mixed fertilizers is considered as coming entirely from bone, and not from South Carolina rock, and is reckoned at three cents per pound.

The *potash* is valued at the price of that ingredient in kainite and the muriate, that is at 4½ cents per pound.

The valuation of a fertilizer is obtained by multiplying the percentages of the several ingredients by twenty (which gives the pounds per ton), and these products by the prices per pound. The

* Dissolved from 2 grams of the unground phosphate previously extracted with pure water by 100 c. c. neutral solution of Ammonium Citrate sp. gr. 1.09 in 30 minutes at 65 degrees c., with agitation once in five minutes. Commonly called "reverted" or "backgone" Phosphoric Acid.

sum of the several final products is the market value of the fertilizing ingredients in one ton.

These estimated values should be studied in the light of the previous explanations. It will probably rarely happen in this State that a mixed fertilizer can be sold near the point of consumption as low as the Station valuation, the excess of cost representing certain expenses previously enumerated. The Station valuations give the consumers a fairly accurate basis for estimating the relative cost of plant food in the various brands of fertilizers, and will help the farmer to determine whether he can in any way profitably change his method of buying fertilizing ingredients. A caution should be uttered, however, against making too close an application of the Station valuations, as a difference of a few cents, or even a dollar, on a ton between two brands may have no real significance, but may be due to unavoidable errors of sampling and analysis, that render it impossible to determine to the utmost exactness the composition of the entire bulk of material that is sold.

The laboratory methods used are those agreed upon by the Association of Official Agricultural chemists.

1. Nitrogen was determined by the method of Kjeldahl.
2. Phosphoric acid was weighed as magnesium pyrophosphate after separation by molybdic acid.
3. Potash was precipitated with platinum bichloride, after separation by the method of Lindo, as modified by Gladding.

VERMONT FERTILIZER LAW.

NO. 109.—AN ACT TO REGULATE THE SALE OF COMMERCIAL FERTILIZERS.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Every lot or parcel of commercial fertilizers, or material used for manurial purposes, sold, offered, or exposed for sale in the State of Vermont, the retail price of which is ten dollars or more per ton, shall be accompanied by a plainly printed statement, clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand, or trade mark under which the fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analysis stating the percentage of nitrogen, or its equivalent in ammonia, of potash, soluble in distilled water, and of phosphoric acid in available form soluble in distilled water, and reverted as well as the total phosphoric acid. In case of those fertilizers, which consist of other and cheaper materials, said label shall give a correct general statement of the composition and ingredients it accompanies.

SEC. 2. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, offered, or exposed for sale, the importer, manufacturer, or party who causes it to be sold, or offers it for sale within the State of Vermont, shall file with the director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act, and shall also deposit with said director, at his request, a sealed jar, glass or bottle, containing not less than one pound of the fertilizers, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 3. The manufacturer, importer or agent of any commercial fertilizer used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the State treasurer, countersiged by the director of the Vermont Agricultural Experiment Station, authorizing the sale of the same in the State, and shall securely affix to each barrel, bag, or other package of fertilizer, the word "licensed," with the number and date of the license. The manufacturer or importer obtaining such license shall pay to the State one hundred dollars for such license, and the license shall expire on the 31st day of December, of the year for which it is issued. One license shall cover all brands manufactured by any one manufacturer, corporation, or company.

SEC. 4. Manufacturers and importers of commercial fertilizers sold, or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizers are sold, offered or exposed for sale, file with the State treasurer a bond, with sureties, residing within the State, satisfactory to said treasurer, in the sum of one thousand dollars, payable to the State and conditioned for the payment of forfeitures and costs imposed on such manufacturers and importers for violating the provisions of this act, and such bond shall be renewed from time to time, as the State treasurer may require.

SEC. 5. The term "commercial fertilizer," as used in this act, shall be taken to mean compounds and manufactured substances containing, or represented as containing, two or more ingredients mentioned in section one of this act, but shall not apply to the separate ingredients used to manufacture the same, or to bone meal, land plaster, lime, or any substance the product of nature which has not been compounded.

SEC. 6. No person shall sell, offer, or expose for sale, in the State of Vermont, any pulverized leather, raw, steamed, roasted, or in any form, as a fertilizer, or as an ingredient of any fertilizer or manure, without an explicit printed certificate of the fact, said certificate to be conspicuously affixed to every package of such fertilizer or manure, and to accompany or to go with every parcel or lot of the same.

SEC. 7. Any person selling, offering, or exposing for sale, any commercial fertilizer, without the statement required by section one of this act, or with a label stating that said fertilizer contains a larger percentage of any one or more of the constituents mentioned in said section than is contained therein, or respecting the sale of which all of the provisions of the foregoing sections have not been fully complied with, shall forfeit fifty dollars for the first offence, and one hundred dollars for each subsequent offence. This section shall not affect parties manufacturing, importing or purchasing fertilizers for their own use, and not for sale in this State.

SEC. 8. All manufacturers and importers of commercial fertilizers, or wholesale dealers in the same, shall, not later than February first, furnish the director of the Vermont Agricultural Experiment Station with a complete list of the brands and of agents selling, offering, or exposing for sale, such fertilizers, and on the first of each succeeding month till May first such additional agents or dealers as in the meantime have been appointed.

SEC. 9. The director shall cause one analysis or more of each fertilizer or material used for manurial purposes, to be made annually, and the result published monthly. Said director is hereby authorized, in person or by deputy, to take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for manurial purposes, which may be in the possession of any manufacturer, importer, agent or dealer; but said sample shall be drawn in the presence of said

party or parties in interest, or their representatives, and shall be taken from a parcel or number of packages which shall not be less than five per cent. of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples, and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer, or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing, and said label shall be signed by the director or his deputy, and by the parties, or party in interest, or their representatives present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the director, and the other by the party whose stock was sampled. The director of the Vermont Agricultural Experiment Station shall notify the State treasurer of all violations of this act, and the State treasurer shall commence a suit, in the name of the State, on the bond required to be filed by such manufacturer or importer, and prosecute the same to final judgment. It shall be the duty of the treasurer, upon ascertaining any violation of this act, to forthwith notify the manufacturers and importers, in writing, and give them not less than thirty days thereafter, in which to comply with the requirements of this act. But there shall be no prosecution in relation to the quality of the fertilizer, or fertilizing material, if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

SEC. 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell fertilizers made in other States.

SEC. 11. Number one hundred and nineteen of the acts of 1882, and number eighty-nine of the acts of 1884, are hereby repealed.

SEC. 12. This act shall take effect January first, 1889.

Approved November 27, 1888.

OBSERVANCE OF THE FERTILIZER LAW.

List of manufacturers who have paid licenses as required by the fertilizer law and of the fertilizers they have offered for sale in the State during the year ending December 31, 1890.

FIRM.	BRAND OF FERTILIZERS.
Bowker Fertilizer Co., Boston, Mass.	Bowker's Hill and Drill Phosphate. Stockbridge Manures. Potato Phosphate. Ammoniated Bone Fertilizer. Sure Crop.
Bradley Fertilizer Co., Boston, Mass.	Bradley's X L Superphosphate. B. D. Sea Fowl Guano. Potato Manure. Bradley's Eclipse Phosphate.
Crocker Chemical & Fertilizer Co., Buffalo, N. Y.	Crocker's Buffalo Ammoniated Bone Superphosphate. Crocker's Buffalo Superphosphate for Potatoes, Hops and Tobacco. Crocker's Buffalo Special Superphosphate. Crocker's Ammoniated Corn Phosphate. Crocker's New Rival Ammoniated Superphosphate.
Clark's Cove Guano Co., J. S. Reese, Licensee, New Bedford, Mass.	King Philip Alkaline Bone. Unicorn. Bay State Fertilizer. Concentrated Corn and Potato Manure. Pilgrim.
Cleveland Dryer Co., Cleveland, O.	Cleveland Superphosphate. Cleveland Potato Phosphate.
Coe, E. Frank, New York, N. Y.	High Grade Superphosphate. Alkaline Bone. Ammoniated Bone Superphosphate.
Cumberland Bone Co., Portland, Me.	Cumberland Superphosphate. Cumberland Seeding Down Fertilizer.
Davidge Fertilizer Co., New York, N. Y.	Special Favorite.

Lister Brothers, Newark, N. J.	Success. Potato Fertilizer. Potato Special, No. 2.
Quinnipiac Co., New London, Conn.	Quinnipiac Phosphate. Quinnipiac Potato Manure. Pine Island Phosphate.
Standard Fertilizer Co., Boston, Mass.	Standard Fertilizer. Standard Guano.
Stewart & Co., W. D. Boston, Mass.	Soluble Pacific Guano.
Williams & Clark Co., New York, N. Y.	Americus Ammoniated Superphosphate. Potato Phosphate.

ANALYSIS OF LICENSED FERTILIZERS.

Station Number.	BRAND.	NITROGEN.			PHOSPHORIC ACID.											POTASH.		
					Soluble.		*Rev'ted.*		*Insol'ble*		*Avail'ble.*		*Total.*					
		Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Valuation at Station Prices.
4012	Bradley's Eclipse Phosphate	1.45	1	$4 93	6.83	8	2.86	2	1.88	2	9.69	10	11.57	12	$16 35	1.77	1.50	$1 59
4014	Williams & Clark Co.'s Potato Phos.	2.67	2	9 08	6.01	6	1.48	1	1.27		7.49		8.76	8	12 59	6.31	6	5 68
4015	Williams&Clark Co.'s Am.A.B.Super	2.46	2	8 36	7.77	7	1.67	3	1.24		9.44		10.68	11	15 68	3.43	2	3 09
4017	Bradley's X. L. Superphosphate	2.60	2.50	8 84	8.05	7	1.76	2	1.88	2	9.81	9	11.69	11	16 65	2.09	2	1 88
4020	Bowker's Potato Phosphate	2.75	2.47	9 35	5.92		2.64		5.33		8.56	7	13.89	13	16 63	2.91	3	2 62
4022	Bowker's Stockbridge Potato Manure	3.29	3.25	11 18	3.38		4.53		4.13		7.91	7	12.04	8	14 69	5.59	5	5 03
4024	Reese's King Philip Alkaline Guano	1.79	1.23	6 09	5.55	4.50	1.18	2	2.31	1	6.73	6.50	9.04	7.5	12 03	3.66	3	3 29
4025	Reese's Unicorn	2.06	1.30	7 00	6.64	6	2.34	3	3.59	1.50	8.98	8.50	12.57	10	16 28	3.45	2	3 11
4026	Lister's Success	1.94	1.03	6 60	6.54		2.92		2.66		9.46	10	12.12		16 44	1.80	1	1 62
4028	Bradley's Potato Manure	2.80	2.50	9 52	5.19	5	2.42	1	1.90	2	7.61	6	9.51	8	13 07	5.87	5	5 28
4029	Quinnipiac Pine Island Phosphate	2.58	2	8 77	4.15	6	6.64	3	1.62	1	10.79		12.41		17 57	1.56	1	1 40
4031	Reese's Bay State	2.73	2.47	9 28	5.64	7	4.06	2	4.29		9.70	9	13.99	11	17 69	2.49	2	2 24
4033	Reese's Concent.Corn& Potato Manu.	2.88	2.80	9 79	4.33	4	2.44	2	2.42	1	6.77	6	9.19	7	12 03	7.75	7	6 98
4035	Cumberland Superphosphate	2.50	2.	8 50	4.99	5	6.13	4	3.01	1	11.12		14.13	12	18 99	2.15	2	1 94
4039	Buffalo Potato, Hop, Tobacco Phos.	2.12	2	7 21	7.40	6	1.55	2	1.76	1	8.95	8	10.71		15 23	4.07	3.50	3 66
4041	E.F.Coe's H.G.Am. Bone Superphos.	1.98	2	6 73	8.21	7	1.98	2	2.13	2	10.19	6	12.32	11	17 39	2.57	2	2 31
4045	Buffalo Ammo. Corn Phosphate	2.23	2.05	7 58	6.69	8	1.84	2	2.35	1	8.53	10	10.88		14 87	2.95	1.60	2 66

LICENSED FERTILIZERS SAMPLED BY STATION.

Station Number.	BRAND.	Drawn at.	Drawn from.
4012	Bradley's Eclipse Phosphate	St. Albans	H. B. Weeks
4014	Williams & Clark Co.'s Potato Phosphate	St. Albans	Clark & Hatch
4015	Williams & Clark Co.'s Americus A. B. Superphosphate	Richford	M. R. Goff
4017	Bradley's X. L. Superphosphate	Newport	Sherman & Braidy
4020	Bowker's Potato Phosphate	Newport	E. B. True
4022	Bowker's Stockbridge Potato Manure	Newport	E. B. True
4024	Reese's King Philip Alkaline Guano	Newport	True & Blanchard
4025	Reese's Unicorn	Newport	True & Blanchard
4026	Lister's Success	Newport	A. W. Pratt
4028	Bradley's Potato Manure	St. Johnsbury	E. K. Ide
4029	Quinnipiac Pine Island Phosphate	St. Johnsbury	B. F. Weeks
4031	Reese's Bay State Fertilizer	St. Johnsbury	Wilder, Noyes & Co.
4033	Reese's Concentrated Corn and Potato Manure	St. Johnsbury	Wilder, Noyes & Co.
4035	Cumberland Superphosphate	St. Johnsbury	Thos. Gagner
4039	Buffalo Potato, Hop and Tobacco Phosphate	Wolcott	Geo. Taylor
4041	E. F. Coe's H. G. Ammo. Bone Superphosphate	Morrisville	G. J. Slayton
4045	Buffalo Ammo. Corn Phosphate	Hyde Park	E. Sherwin

LICENSED FERTILIZERS SAMPLED BY STATION.

Station Number.	BRAND.	Drawn at	Drawn from.
4046	Bradley's Complete Manure	Plainfield	G. D. Kidder
4048	Cleveland Potato Phosphate	Plainfield	G. D. Kidder
4049	Reese's Pilgrim	Newbury	C. J. Richardson
4051	Davidge's Special Favorite	Newbury	J. Wallace
4052	Bradley's B. D. Sea Fowl Guano	Bradford	H. A. Winship
4053	Bowker's Stockbridge Manure for Corn	Bradford	E. H. Welton
4054	Bowker's Sure Crop	Bradford	E. H. Welton
4055	Bowker's Hill and Drill Phosphate	Bradford	E. H. Welton
4057	Cumberland Seeding Down Fertilizer	Northfield	J. M. Temple
4058	Quinnipiac Potato Manure	Barre	W. F. Richardson
4071	Quinnipiac Phosphate	St. Johnsbury	B. F. Weeks
4072	Quinnipiac Pine Island Phosphate	St. Johnsbury	B. F. Weeks
4073	E. Frank Coe's High Grade A. B. Superphosphate	Morrisville	G. J. Slayton
4074	E. Frank Coe's Ammo. Bone Superphosphate	Morrisville	G. J. Slayton

ANALYSIS OF LICENSED FERTILIZERS.

Station Number.	BRAND.	NITROGEN.			PHOSPHORIC ACID.											POTASH.		
					Soluble.		*Rev'ted.*		*Insol'ble*		*Available.*		*Total.*					
		Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Valuation at Station Prices.
4046	Bradley's Complete Manure	3.83	3.73	$13 02	6.15	6	2.23	2	1.29	1	8.58	8	9.87	9	$14 28	5.42	6	$4 88
4048	Cleveland Potato Phosphate	2.21	2.05	7 51	8.13	6	1.78	2	1.27	2	9.91	8	11.18		16 44	2.68	3.25	2 41
4049	Reese's Pilgrim	1.81	1.	6 15	5.22	4.50	1.02	2	2.29	1	6.24	6.50	8.53	7.50	11 26	3.22	2.50	2 90
4051	Davidge's Special Favorite	1.46	0.82	4 96	9.27		0.56		0.01		9.83	10	9.84	11	15 68	1.83	1.50	1 65
4052	Bradley's B. D. Sea Fowl Guano	2.82	2.50	9 59	8.12	7	1.47	2	1.56	2	9.59	9	11.15	11	16 14	2.91	2	2 62
4053	Bowker's Stockb'ge Manure for Corn	3.21	3.25	10 91	5.25		2.26		4.06		7.51	8	11.57	9	14 23	3.96	4	3 56
4054	Bowker's Sure Crop	1.15	0.82	3 91	4.00		5.18		4.43		9.18	9	13.61	11	16 83	1.55	1	1 40
4055	Bowker's Hill and Drill Phosphate	2.55	2.50	8 67	7.77		2.44	2	2.57		10.21	8	12.78	12	17 63	2.04	2	1 84
4057	Cumberland Seeding Down Fertilizer	1.75	1.65	5 95	2.48	2	4.23	3	11.61	11	6.71		18.32	18	17 29	1.26	1	1 13
4058	Quinnipiac Potato Manure	3.40	2.50	11 56	2.63	3	3.99	2	2.01	1	6.62		8.63		22 26	5.27	5	4 74
4071	Quinnipiac Phosphate	3.03	2.50	10 30	3.20	6	7.49	3	2.45	1	10.69		13.14		17 83	2.08	2	1 87
4072	Quinnipiac Pine Island Phosphate	2.88	2	9 79	3.81	6	7.11	3	1.94	1	10.92		12.86		17 93	1.33	1	1 20
4073	E.F.Coe's High Grade A B Superphos	2.05	2	6 97	8.38	7	1.64	2	2.00	2	10.02	9	12.02	11	17 07	2.47	2	2 22
4074	E. F. Coe's Ammo. Bone Superphos	1.84	1.50	6 25	7.68	6	2.35	2	2.77		10.03	8	12.80		17 48	1.51	1.35	1 36

AVAILABILITY OF NITROGEN IN FERTILIZERS.

Station Number.	BRAND.	Total Nitrogen.	Nitrogen from Ammonia Salts.	Nitrogen from Nitrates.	Organic Nitrogen.	Organic Nitrogen soluble in Pepsin solution.	Per cent. of Organic Nitrogen soluble in Pepsin solution.	Per cent. of total Nitrogen immediately available.
4012	Bradley's Eclipse Phosphate	1.45	0.14	....	1.31	0.91	69	72
4014	Williams & Clark Co.'s Potato Phosphate	2.67	0.46	0.20	2.01	1.39	69	77
4015	Williams & Clark Co.'s Americus Ammo. Bone Superphosphate	2.46	0.51	....	1.95	1.37	70	76
4017	Bradley's X. L. Superphosphate	2.60	0.24	0.20	2.16	1.35	63	69
4020	Bowker's Potato Phosphate	2.75	0.12	0.51	2.12	1.37	65	73
4022	Bowker's Stockbridge Potato Manure	3.29	0.78	0.71	1.80	1.21	67	82
4024	Reese's King Philip Alkaline Guano	1.79	0.23	....	1.56	0.85	54	60
4025	Reese's Unicorn	2.06	0.29	....	1.77	1.14	64	70
4026	Lister's Success	1.94	0.38	....	1.56	0.76	49	59
4028	Bradley's Potato Manure	2.80	0.11	0.49	2.20	1.66	75	81
4029	Quinnipiac Pine Island Phosphate	2.58	0.64	....	1.94	0.94	48	61
4031	Reese's Bay State Fertilizer	2.73	0.31	....	2.42	1.42	59	63
4033	Reese's Concentrated Corn and Potato Manure	2.88	0.23	0.31	2.34	1.48	63	70
4035	Cumberland Superphosphate	2.50	0.29	0.37	1.84	1.47	80	85
4039	Buffalo Potato, Hop and Tobacco Phosphate	2.12	0.19	....	1.93	1.27	66	69
4041	E. F. Coe's High Grade Ammo. Bone Superphosphate	1.98	0.58	....	1.40	0.91	65	75
4045	Buffalo Ammo. Corn Phosphate	2.23	0.19	....	2.04	1.25	61	65

AVAILABILITY OF NITROGEN IN FERTILIZERS.

Station Number.	BRAND.	Total Nitrogen.	Nitrogen from Ammonia Salts.	Nitrogen from Nitrates.	Organic Nitrogen.	Organic Nitrogen soluble in Pepsin solution.	Per cent. of Organic Nitrogen soluble in Pepsin solution.	Per cent of total Nitrogen immediately available.
4046	Bradley's Complete Manure	3.83	1.23	0.36	2.24	1.73	77	87
4048	Cleveland Potato Manure	2.21	0.18	....	2.03	1.38	68	71
4049	Reese's Pilgrim	1.81	0.23	....	1.58	0.94	60	65
4051	Davidge's Special Favorite	1.46	0.12	....	1.34	0.30	22	29
4052	Bradley's B. D. Sea Fowl Guano	2.82	0.13	0.44	2.25	1.50	67	73
4053	Bowker's Stockbridge Manure for Corn	3.21	0.18	1.04	1.99	1.54	77	86
4054	Bowker's Sure Crop	1.15	0.21	0.08	0.86	0.46	53	65
4055	Bowker's Hill and Drill Phosphate	2.55	0.13	0.47	1.95	1.46	75	81
4057	Cumberland Seeding Down Fertilizer	1.75	0.14	0.43	1.18	0.82	69	79
4058	Quinnipiac Potato Manure	3.40	0.54	0.63	2.23	1.24	56	71
4071	Quinnipiac Phosphate	3.03	0.47	0.35	2.21	1.32	60	71
4072	Quinnipiac Pine Island Phosphate	2.88	0.66	....	2.22	1.25	56	66
4073	E. Frank Coe's High Grade Ammo. Bone Superphosphate	2.05	0.59	....	1.46	1.07	73	81
4074	E. Frank Coe's Ammo. Bone Superphosphate	1.84	0.22	....	1.62	1.22	75	78

LICENSED FERTILIZERS SAMPLED BY MANUFACTURERS.

Station Number.	BRAND.	MANUFACTURED BY
4061	Buffalo Ammoniated Bone Superphosphate	Crocker Fertilizer and Chemical Co., Buffalo, N. Y.
4063	Buffalo Special Superphosphate	" " " " " "
4064	Buffalo New Rival Ammo. Superphosphate	" " " " " "
4066	Lister's Potato Fertilizer	Lister's Agricultural Chemical Works, Newark, N. J.
4067	Lister's Potato Special No. 2	" " " " " "
4068	Soluble Pacific Guano	W. D. Stewart & Co., Selling Agents, Boston.
4069	Cleveland Superphosphate	Cleveland Dryer Co., Cleveland.
4080	Bowker's Ammoniated Bone Fertilizer	Bowker Fertilizer Co., Boston and New York.

ANALYSIS OF LICENSED FERTILIZERS.

Station Number.	BRAND.	NITROGEN.			PHOSPHORIC ACID.											POTASH.		
					Soluble.		*Rev'ted.*		*Inso'ble*		*Available.*		*Total.*					
		Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Found.	Guaranteed.	Valuation at Station Prices.	Found.	Guaranteed.	Valuation at Station Prices.
4061	Buffalo Ammo' Bone Superphosphate	3.22	2.90	$10 95	6.29	8	1.69	2	2.22	1	7.98		10.20		$13 93	2.04	1	$1 84
4063	Buffalo Special Superphosphate . .	2.13	1.65	7 24	6.42	6	0.90	2	3.58	1	7.32		10.90		13 77	2.50	1	2 25
4064	Buffalo New Rival Ammo. Superphos.	1.51	1.15	5 13	5.89	8	1.86	2	2.84	1	7.75		10.59		13 92	3.01	1.60	2 71
4066	Lister's Potato Fertilizer	7.32	3.70	24 89	5.49		1.21		0.47		6.70	8.50	7.17		10 88	3.77	7	3 39
4067	Lister's Potato Special No. 2 . . .	2.40	1.80	8 16	6.82		5.11		2.75		11.93	9.25	14.68		20 23	4.52	4	4 07
4068	Soluble Pacific Guano	2.37	2.25	8 06	7.65	7	2.40	1.50	1.75	2	10.05		11.80	10	16 89	2.10	2	1 89
4069	Cleveland Superphosphate	2.58	2.05	8 77	8.13	7	1.80	2	1.94	2	9.93	9	11.87	10.50	16 87	1.90	2	1 71
4080	Bowker's Ammo. Bone Fertilizer .	2.33	2.00	7 92	6.10		2.16		5.59		8.26	8	13.85	10	16 35	1.91	2	1 72

AVAILABILITY OF NITROGEN IN FERTILIZERS.

Station Number.	BRAND.	Total Nitrogen.	Nitrogen from Ammonia Salts.	Nitrogen from Nitrates	Organic Nitrogen	Organic Nitrogen soluble in Pepsin solution.	Per cent. of Organic Nitrogen soluble in Pepsin solution.	Per cent. of total Nitrogen immediately available.
4061	Buffalo Ammo. Bone Superphosphate	3.22	0.19	....	3.03	2.10	69	71
4063	Buffalo Special Superphosphate	2.13	0.24	....	1.89	1.16	61	66
4064	Buffalo New Rival Ammo. Superphosphate	1.51	0.20	....	1.31	0.66	50	57
4066	Lister's Potato Fertilizer	7.32	4.50	...	2.82	2.13	76	91
4067	Lister's Potato Special No. 2	2.40	0.35	....	2.05	1.15	56	63
4068	Soluble Pacific Guano	2.37	0.45	0.25	1.67	1.14	68	78
4069	Cleveland Superphosphate	2.58	0.44	0.31	1.83	1.24	68	77
4080	Bowker's Ammo. Bone Fertilizer	2.33	0.09	0.56	1.68	....	....	....

COMPARATIVE VALUE OF FERTILIZERS LICENSED IN 1889 AND 1890.

Of the forty brands of commercial fertilizers sold in the State during the years 1889 and 1890, sixteen standard brands have been selected for a comparison between the character of the goods sold under these brands in each of the two years. Only those brands were selected which have been sold in the State during both of the years.

AVERAGE COMPOSITION IN 1889.

Name of Fertilizing Ingredient.	Pounds in a hundred.	Pounds in a ton.	Price per pound.	Valuation at 1889 prices.
Nitrogen	2.65	53	× 17	$ 9.01
Soluble Phosphoric Acid	7.07	141	× 8	11.28
Reverted Phosphoric Acid	2.90	59	× 7½	4.43
Insoluble Phosphoric Acid	2.45	49	× 3	1.47
Available Phosphoric Acid	10.02	200		
Total Phosphoric Acid	12.47	249		
Potash	3.01	62	× 4½	2.71
Total valuation per ton				$28.90

AVERAGE COMPOSITION IN 1890.

Name of Fertilizing Ingredient.	Pounds in a hundred.	Pounds in a ton.	Price per pound.	Valuation at 1890 prices.
Nitrogen	2.46	49	× 17	$8.33
Soluble Phosphoric Acid	6.18	124	× 8	9.92
Reverted Phosphoric Acid	3.04	61	× 7½	4.57
Insoluble Phosphoric Acid	2.52	50	× 3	1.50
Available Phosphoric Acid	9.22	184		
Total Phosphoric Acid	11.74	235		
Potash	3.05	61	× 4½	2.74
Total valuation per ton				$27.06

From these tables it will be seen that the quality of the fertilizers sold has changed quite decidedly during the past year. Notwithstanding the fact that the price of materials furnishing nitrogen

has decreased so that the valuation has been lowered from 19 cents a pound to 17, yet fertilizer manufacturers have decreased the amount of nitrogen in their goods by $0.68 per ton. At the same time, though there has been no change in the price of materials containing phosphoric acid, the amount of it in the fertilizers has dropped $1.20. Potash has remained the same in price and amount. On the whole, therefore, these sixteen brands of fertilizers, which constitute the great bulk of all the fertilizers in the State, have a valuation this year of $1.84 less than last, when calculated on the same prices. But since the selling price in Vermont averages about twenty-five per cent. above the valuation, it follows that this amount should be added to the difference in valuation to get the real difference in commercial value, and this gives $2.30. That is, in order that the farmer may get the same return for his money, he should purchase his fertilizers for $2.30 per ton cheaper than he did last year. There has been no fall in retail price corresponding to this decrease in quality. The decrease in price on these sixteen brands has been $0.88. This means then that while the cost of the raw materials to the manufacturers has decreased, yet these manufacturers have so lowered the quality of their goods as to make the farmer pay about a dollar and a half more per ton than last year for the same amount of plant food. This amounts to $6,000 on the fertilizer business of this State.

FERTILIZER STATISTICS.

The amount expended annually by the farmers of the State for commercial fertilizers has been variously estimated at from one hundred thousand to half a million dollars. To find out the truth of the matter, the Station has made a very careful canvass of the State to ascertain how many tons of fertilizer were unloaded in 1888 at the railroad stations. It does not necessarily follow that all was sold that was brought into the State, but there seems to be good reasons for thinking that not much more fertilizer was carried over to the spring of 1889 than was on hand the spring of 1888, so that the amount brought into the State during the year will be a fairly close approximation to the amount sold.

Statements were collected from one hundred and two railroad stations in the State, and these figures used as a basis for estimating the amount that was probably unloaded at the rest of the stations.

The total figures for the State are four thousand one hundred and ninety-four (4194) tons. The average selling price was not far from $35.63 per ton; making a total of $149,432.22 paid by the farmers of the State during the year 1888 for the single item of commercial fertilizers. It is safe to say that at least $30,000 of this large sum could have been saved if the system of small purchases on long time could be replaced by the English system of co-operative buying for cash.

THE WASTES OF THE DAIRY.

BY W. W. COOKE, MEMBER OF THE BOARD OF AGRICULTURE.

The word wastes may be used in connection with dairying with two distinct meanings. It may be used to mean the things that are thrown away needlessly, that is, wasted, or it may be used to mean the by-products, such as skim milk, buttermilk and whey, which occurs in the manufacture of milk. The wastes of the dairy will be treated here with both meanings, and we will refer first to those wastes which are unnecessary.

The waste of fertilizers is enormous. The common custom of the State is to turn the cows back into a pasture during the night, for the summer season, which will average about five and a half months. During this time no manure is made at the barn from these cows, whatever they produce being scattered over the barnyard, lane and pasture. Some farmers are beginning to practice the method of keeping their cows in the stanchions every night in the year. Leaving out of account the saving of labor and increase of milk from this method, let us look at the saving of manure. The best authorities unite in saying that a ton of manure at the barn of a farm is worth twice as much to the farm as that same manure dropped in the pasture by the cows while grazing. Theoretically there ought to be but little difference, but in practice it is found that manure scattered in small quantities irregularly over the pasture has not more than half the value of the same manure properly stored at the barn, ready to be put wherever on the farm it is most needed. It is safe to say that one-half the value of the manure produced during the night, equal to one-quarter of that produced in the whole twenty-four hours, is wasted under the present system. This amounts to one-quarter of all the manure made by the cows of the State during the five and a half summer months. To determine the cash value of this loss it will be necessary to know the value of the manure made by a cow during the summer. A cow will eat at least enough pasture grass daily to weigh, if made into hay, twenty-five pounds. Such hay would have a fertilizing value, after passing through the animal, of $8.80 per ton. During the one hundred and sixty-five days of pasture feeding, the cow would eat the equivalent of two tons of such hay, having a fertilizing value of $17.60. On the first day of January, 1890, there were in the State of Vermont, very nearly 235,000 cows. If each cow produces $17.60 worth of manure during the summer, the total amount made would be $4,136,000; and if one-fourth of

this is wasted by the system of turning the cows back into the pasture at night, the loss to the farmers of the State from this source alone, amounts to $1,034,000.

But this is far from the only source of loss of fertilizers from the dairy. Our farmers do not save carefully enough the manure that is made at the barns during the winter. This is a subject that has been talked about a great deal at agricultural meetings, and it is gratifying to note the decided improvement that has taken place in this respect. There is still room for and great need of further improvement. It is not the intention here to enter fully into the subject, but to call attention to the immense waste that is still going on in the State. The largest part of this waste could be cheaply avoided by the use of absorbents, and a simple shed roof over the manure pile to keep off rain and the drippings from the eaves. Experiments that have been made to determine the waste of manure under the methods still used on the majority of our farms, show a loss in individual cases of from 15 to 45 per cent. It would probably be safe to estimate that at least 20 per cent. of all the plant food contained in the manure made during the winter on the farms of this State is lost and never finds its way back to the fields that are so much in need of it. It takes at least two and a half tons of hay or its equivalent to feed a cow through a Vermont winter, which for our 235,000 cows, would be 587,500 tons of hay. The manure from this hay, allowing 20 per cent. of the plant food as taken in passing through the animal, is still worth $6.21 per ton, or $3,648,375 per winter. A loss of 20 per cent. of this sum means $729,675 worth of fertilizer needlessly wasted in the dairies of this State each winter, or a total of $1,763,675 wasted during the year. Vermont buys about $150,000 worth of commercial fertilizers annually, or in other words, she wastes about ten dollars worth for each dollar expended.

Other wastes occur besides those in fertilizers, and it is to two of them, the waste in the skimmilk and the buttermilk, that we wish to call attention. The 235,000 cows of Vermont produce not far from 763,750,000 pounds of milk annually; of which about 120,000,000 pounds is made up at creameries and cheese factories, and 70,000,000 pounds used as milk in towns and in the country, leaving 573,750,000 pounds to be made into butter on the farms. This is finally divided into about 23,000,000 pounds of butter, 91,750,000 pounds buttermilk and 459,000,000 pounds skimmilk. Our Experiment Station has made a great many tests of buttermilk and skim milk from creameries and private dairies, and in almost every case the creamery has done the better work, that is, there is less loss in each hundred pounds of skimmilk and buttermilk from the creameries than from the farm dairies. An average of a large number of analyses shows less than a half of one per cent. of fat left in the skimmilk from creameries, while the average of all our analyses of skimmilk from farms shows at least three-quarters of one per cent. of fat. It is probably well within the facts to say that there is a loss in all the skimmilk produced on the farms of this State

of a quarter of one per cent. of fat more than would be lost if the same milk had been handled at a creamery. Part of this gain in the creamery is due to the greater care and part due to the fact that it is always more economical to handle large than small quantities of milk. Few farmers have in their buttermilk less than one per cent. of fat, and we have analyzed samples containing three and four per cent. In creameries the average is a litttle over half of one cent., so that creameries will average saving at least half of one per cent. of fat in the buttermilk more than is saved in the private dairy. A quarter of one per cent. of fat lost in all the skimmilk on our farms means a loss of at least 1,147,500 pounds of butter annually, and one-half of one per cent. loss in the buttermilk means an additional loss of 458,750 pounds of butter, or a total of 1,606,250 pounds of butter wasted from making up the milk at home instead of in a creamery. At 20 cents a pound, this would be worth $321,250, *a sum sufficient in five years to build and equip enough creameries to handle the entire milk product now made into butter on our farms.*

It would seem then that there is an annual needless waste in the dairies of this State in manure, skimmilk and buttermilk of $2,084,925 or about $9 per cow. When we consider that the average annual product per cow in Vermont is not over $26 worth of milk and its products and $12 worth of manure, the possibility of adding *seven* per cent. to the value of the milk products and thirty-five per cent. to the value of the available manure, is well worth the serious consideration of our farmers.

The second meaning of the word wastes refers to the waste products or by-products in the manufacture of milk. They come under the three heads of buttermilk, skimmilk and whey, and the question is how these waste products can be utilized to the best advantage, how these can be used with the least waste possible. It may not have been considered how much of these waste products are produced in this State. From 763,750,000 pounds of milk produced annually in the State are finally produced about 106,150,000 buttermilk, 531,000,000 pounds of skimmilk and 27,000,000 pounds of whey. On the supposition that buttermilk is worth sixteen cents a hundred, skimmilk fifteen, and whey nine cents a hundred, there will be a total value of $1,000,000 worth of waste product of the dairy produced in the State annually. How best to utilize this large amount of animal food, is a subject that will bear considerable thought. These waste products differ decidedly in composition, and in order to understand how to use them properly one must know how they are composed. The following table gives the composition of each.

	Protein.	Sugar.	Fat.	Ash.	Nutritive. Ratio.
Whole milk.....	3.4	4.8	4.1	0.7	1:4.4
Skimmilk.....	3.5	5.0	0.7	0.8	1:1.9
Buttermilk.....	3.0	5.4	1.0	0.5	1:2.6
Whey.....	1.0	5.0	0.6	0.6	1:6.5

It will be noticed in studying it that there are about the same amount of albuminoids in the skimmilk as in the whole milk, which is due to the fact that in making the butter little is taken from the milk except the fat. The sum of the parts given here for whole milk, foot up to about 13.00 per cent. of total solids. This is about the average of our Vermont milk for the year, though during the fall and early spring the milk is richer than that, while during May and June it is poorer. Our Vermont law demands that milk shall contain 12.50 per cent. total solids, and almost all the milk of this State runs above this standard. But few samples thus far analysed at our Experiment Station have been found to be below this, unless they had been tampered with, either watered or skimmed. Milk that contains 13.00 per cent. of total solids will usually require about twenty-three pounds of milk to make a pound of butter, and the statistics from the creameries of the State show that that is about the average amount required during the whole year. Milk of that quality contains 3.4 per cent. of albuminoids, 4.8 per cent. of sugar, 4.1 per cent. of fat and .7 per cent. of ash. Now when that milk is skimmed the principal change is in the amount of fat, the .7 per cent. of ash changes to to .8, 4.8 per cent. of milk sugar to 5.0 per cent., 3.4 per cent. of albuminoids to 3.5. The other parts are increased but slightly, and the fat is decreased from 4.1 to .7. In the creameries this per cent. of fat in the skim milk will run considerably lower, and on the farm it will run a trifle above, as the average of analyses of Vermont farm skimmilk is about three-fourths of one per cent. In changing from whole milk to buttermilk there has again been a decrease of most of the fat. The ash changes but little, .5 per cent. instead of .7, the milk sugar is increased from 4.8 to 5.4, and the albuminoids change in 3.4 to 3. Still the changes are but slight so far as the albuminoids, sugar and ash are concerned, and the buttermilk on the whole is not much different from the skimmilk, but in the case of whey we find a decided difference, for in the cheese we want just as much protein as possible and in the butter just as little. Cheese making is not perfect any more than is butter making; indeed there cannot as good work be done in cheese making as in butter making. If the butter making were perfect there would be no fat in the buttermilk or in the skimmilk. If the cheese making were perfect there would be neither fat nor protein in the whey, which would consist of water flavored with milk sugar, and containing a small amount of mineral matter in solution. Such perfect work as this cannot be done by the cheese maker. Of the four pounds of fat in a hundred pounds of milk, but little more than three pounds are carried into the cheese, leaving quite a large proportion to go into whey, and of the protein, that is, the caseine and albumen of the milk, quite a little escapes the cheese maker and passes into the whey. The amount of fat in the whey is just about the same as in the skimmilk, and the amount of sugar differs but litttle, the great difference being in the amount of protein present.

In feeding we have to pay some attention to the proportion of the different parts of fodder. Enough has been printed about the science of stock feeding, so that most farmers have an idea of what is meant by the proportion of the fodder, that different waste products have very different proportions. In milk the fat and the milk sugar are the heat producing part, and the protein the muscle producing parts. In the whole milk there is one part of muscle producing to 4.4 parts of heat producing, in skimmilk 1 :1.9, butter milk 1 :2.6, while in the whey there is 1 :6.5, that is, there are six and a half times as much heat producing as muscle producing food. We can say then that whey is deficient in the muscle producing part, while the skimmilk and the butter milk have rather an excess.

There are several ways of figuring the value of these waste products. Let us figure them out in two ways: One hundred pounds of linseed meal contains almost exactly the same number of pounds of albuminoids, starch, sugar and fat as is contained in seven thousand pounds of skimmilk. One thousand pounds of linseed meal costs $13, therefore the value of seven thousand pounds of skimmilk should be $13, which would be the same as eighteen cents a hundred pounds. One thousand pounds of gluten meal contains the same amount of feeding material as eight thousand pounds of buttermilk and costs $12.50, which would make the buttermilk worth fifteen cents a hundred. Five hundred pounds bran and five hundred pounds of corn meal make a mixture which has the same ingredients as ten thousand pounds of whey. Such a mixture costs $9, and the whey therefore ought to be worth nine cents a hundred. We can arrive at the market value of these feeds in another way, by comparing them all with bran. One hundred quarts of skimmilk and fifty pounds of corn meal have the same ingredients as one hundred pounds of bran. If the bran is worth eighty cents, and the corn meal forty-five cents, a hundred quarts of skimmilk should be worth the difference, or thirty-five cents, which would be the same as sixteen cents a hundred. One hundred and thirty quarts of buttermilk, and forty pounds of corn meal have again the same ingredients as a hundred pounds of bran, which would make the buttermilk figure out fifteen cents a hundred. Two hundred quarts of whey and thirty-five pounds of gluten meal have also the same value as a hundred pounds of bran, or eight cents a hundred for whey. It will be noticed that these two methods of figuring give slightly different results, one eighteen cents a hundred for skimmilk and the other sixteen. One gives nine cents a hundred for whey and the other eight cents, but these results are so close to each other that they are probably not far from the truth.

HOW SHALL THESE WASTE PRODUCTS BE FED MOST PROFITABLY.

They are fed of course to stock, and there are on the farm cows calves and pigs to which they can be fed. Which of these animals are going to give the best returns? Is it profitable to feed any of these cows? It is probably that not more than two dairymen out of a hundred would claim that there was a profit in feeding the skimmilk back to the cows, though the skimmilk given to a cow that yields twenty pounds of milk a day would have the same theoretical feeding value as three pounds of bran. It is difficult to see any reason why good results should not be obtained from feeding skimmilk to cows, but the almost universal practice of the country among farmers is strong presumptive evidence that this method cannot be used with profit. Feeding calves these wastes of the dairy give fairly good results. Both the skimmilk and the buttermilk are so rich in the flesh producing part that they form an excellent food for building up the system of growing animals, so that they are well adapted to the raising of calves, not indeed to be fed alone but with the addition of a little oil meal. The calves should also have whatever coarse fodder they can eat. If the skimmilk is from the cold, deep setting it should be warmed before being fed to the calves. It is of course impossible to say how much value per hundred pounds one ought to expect to get from skimmilk and buttermilk fed in this way, but it is doubtful if on the average the farmers of this State realize more than ten cents a hundred.

In most of the dairies of the State the skimmilk and the buttermilk, and especially the whey, is fed to pigs. By far the larger part of these waste products in the State probably find their way ultimately to the pig pen. In studying how best to utilize these for feeding to pigs we shall have to pay particular attention to the proportion of the parts of the fodder, because the pig requires different proportions at different times of its life. When the pig weighs about fifty pounds it requires about three parts of heat producing food to one part of that producing muscle, that is, three parts of milk sugar and milk fat, or their equivalent, to one part of the protein of the milk, or of some other albuminoid. The relative amount of fat producing food material becomes continually greater as the pig grows older, until by the time the pig weighs two hundred pounds the proper ration is 1 :4.5. Starting with the fifty pound pig the ratio is 1 :3. We find that skimmilk alone has a ratio of about 1 :2, and is deficient in the heat producing part with an abundance of the flesh producing. Buttermilk with its ratio of 1 :2.6 is quite close to the requirements of the pig, while whey with a ratio of 1 :6.5 would be entirely on the other side, it being deficient in the muscle producing food ingredients. If we are to make skimmilk the basis of feeding this fifty pound pig we must add to it something that has an abundance of starch, and this we have in corn meal and middlings. The following table gives the amount of digestible matter required by a pig in one day.

	Protein.	Carbohydrates	Fat.	Nutritive Ratio.
50 pounds.....	0.35	0.78	0.08	1:2.9
100 "	0.64	1.79	0.14	1:3.3
150 "	0.79	2.86	0.19	1:4.2
200 "	0.85	3.24	0.21	1:4.4

At its different periods of growth by comparing them youwill notice that the pig's appetite increases just about as fast as his weight. Particular attention is called to the column giving the amount of fat consumed by a pig daily, since even at the most it amounts to but one-fifth of a pound, while the pig that is eating it may increase in weight from two to three pounds a day, nearly one-half of which will be pure fat. It is evident that the fat in the flesh of the pig does not come alone from the fat that is in the food. It can be said in general that most of the fat that is laid up in the animal system, is produced from the albuminoids, but that in the case of the pig it seems pretty well settled that sometimes fat is produced from the starch or sugar.

A pig weighing fifty pounds will require daily about four quarts of skimmilk, and eight ounces of corn meal. This would make a pretty good ration for the pig from the time it was weaned until it weighed about sixty pounds. Two ounces of corn meal to each quart of skimmilk, makes almost a perfect ration for a young, growing pig, and this ration can be kept up, increasing its weight, as the appetite of the pig increases, until there is being given six quarts of milk and twelve ounces of corn meal. Most farmers would think it more profitable to feed a larger amount of skimmilk than six quarts, but it is doubtful, whether in the long run, there is not more profit in keeping more pigs, and feeding them such a small amount of skimmilk, and supplementing quite a large amount of grain. This is especially true of the farmer, who is producing approximately the same amount of milk throughout the year, whereas, for the man who is running entirely a summer dairy, it may be more profitable to feed a larger amount of skimmilk to a pig during the flush of the season, and then decrease as the cows shrink in the early fall. Figuring out this ration, for the growing pig six quarts of skimmilk being taken as the maximum, whatever more required being given in the form of grain, at one hundred pound live weight, the ration would be six quarts of milk, twenty ounces of corn meal, and twelve ounces of bran, which would have to be increased by the time the pig weighed one hundred and fifty pounds, to six quarts skimmilk, forty ounces corn meal, and twenty ounces of bran, and at two hundred pounds live weight, the ration would be six quarts of milk, forty-eight ounces of corn meal, and twenty-four ounces of bran. In giving these rations at some of the agricultural meetings in this State, a general claim has been made that they were not large enough, that it would be starving pigs to attempt to keep them on such small rations; but it should be noted that these rations are for pigs kept in pens, for the

simple purpose of growing and feeding them the most economically. If the pig is to be allowed to run in the open field, or even in a small barn-yard, where they can get a plenty of exercise, they would eat a much larger amount of food without giving any corresponding increase in live weight. If one prefers to use middlings instead of bran, and in the place of part of the corn meal, the ration could be made as follows: for a fifty pound pig, four quarts of milk, eight ounces middlings; one hundred pound pig, six quarts of milk, sixteen ounces corn meal, and sixteen ounces middling; one hundred and fifty pound pig, six quarts of milk, thirty-six ounces corn meal, thirty-six ounces middlings; two hundred pound pig, six quarts skimmilk, forty-eight ounces corn meal, and twenty-four ounces middlings.

In feeding buttermilk instead of skimmilk, the ration of grain will not need to be much changed, but since the proportion of starch and sugar is a little larger in buttermilk than in skimmilk, no grain will be needed to be added to it, to make a perfect ration for a fifty pound pig. For a hundred pound pig, the buttermilk can be increased to eight quarts, with an addition of sixteen ounces of corn meal, and eight ounces bran; for one hundred and fifty pound pig, eight pounds of buttermilk, thirty-four ounces of corn meal, and eighteen ounces of bran; for the two hundred pound pig, eight quarts of milk, forty-four ounces of corn meal, and twenty ounces of bran.

The problem of getting a profit from the feeding of whey to pigs is much more complicated, for young, growing pigs need a ration that is richer in the muscle or flesh-producing part of the food, while whey is deficient in this portion, and consists principally of the fat-producing part. We have no grain that is safe to feed to a pig to balance up the whey to make it a perfect ration; cotton-seed meal would do it, but it would kill the pig; oil meal would do it, if it could be used in any quantity, particularly the new process oil meal, but neither of these are profitable to use. Buckwheat middlings probably comes the nearest to what is wanted, and it is not often that they can be obtained in sufficient quantities. Ten quarts of whey to eight ounces of buckwheat middlings, would make a fair daily ration for a fifty pound pig. It certainly is a fact that whey is in bad repute among farmers for feeding. The reason for this is very likely, in part, due to this fact that the whey is not properly balanced, and that farmers are not in the habit of feeding anything else with the whey to give it the proper proportions. There is another reason, also, in the bad condition of the whey when it gets back to the farm. There is also a loss in feeding-value during the souring of the whey, since, it is of course, the milk-sugar that turns to acid. The acid, as far as we know, has no feeding value. In skimmilk the amount of this acid may rise to about .8 of one per cent. In the whey, it seldom, if ever, gets higher than one per cent., but to produce one per cent. of acid would require, at least, one per cent. of milk-sugar, which would be one-fifth of the total milk-sugar present

lost in the souring of the whey. This is, probably, rather a low estimate of the actual loss of feeding-value that takes place when the whey is allowed to sour before it is fed.

As to the relative influence on the health of the animal of sour whey and sweet whey, and sour skimmilk and sweet skimmilk, there is a difference of opinion. Most farmers claim that for some reason or other the sour milk is a little better for the health of the pigs. On the contrary there is a farm in New England that raises some of the best pork that goes to market, a farm that gets a rapid and profitable growth on the pigs, and yet these three hundred pigs are fed almost entirely on sweet skimmilk. For a fifty pound pig then ten quarts of whey and eight ounces of buckwheat middlings would come quite close to the standard ration. It would be above the standard if all the milk sugar were saved, but the losses that occur in the souring will probably bring down the actual amount fed to about the standard: for a hundred pound pig, twelve quarts of whey, sixteen ounces buckwheat middlings, sixteen ounces gluten meal and eight ounces corn meal: for a hundred and fifty pound pig, fifteen quarts of whey, sixteen ounces middlings, sixteen gluten meal and eight ounces corn meal: a two hundred pound pig, twenty quarts whey, sixteen middlings, eight ounces gluten, and sixteen corn meal.

It may not be amiss in the present connection to refer the reader to some tests in pig feeding that were made at our Experiment Station. In that test there were two questions in mind. One was the question of breed, and the other the question of the most profitable time to market pigs, that is, an endeavor to find out how long they could be fed and still make a profit. There is no object in keeping pigs when the cost of the food given each day is equal in value to the market price of the pork produced. During this feeding trial there were three breeds tested, the Chester White, Berkshire and Yorkshire, and in this particular test the Chester Whites did a little the best; but we cannot tell whether this result was due to the breed or whether these Chesters were better in individual quality than the other pigs. Any conclusive results in regard to the comparative merits of different breeds will have to be tested many times over before any reliable results can be obtained. The following tables give the results obtained with the pigs.

It was intended to feed four distinct kinds of rations, differing in their *nutritive ratio*, or the proportion between the flesh-producing and the heat or fat producing parts of the food. The first period extended from the time they were weaned until they weighed about 60 to 70 pounds, and a ratio of about 1 :2 was used. The second with a ratio of 1 :2.9, continued until the live weight had attained 100 pounds. The third period from 100 to 130 pounds had a ratio of 1 :3.7, and the fourth, continuing from then until the pig was sold, had a ratio of 1 :4.25. This is strictly in accordance with the needs of the animal's system, since, as the pig grows older, it uses a continually smaller *proportion* of its food for producing

flesh or growth and a larger part for merely keeping up animal life. This fact lies at the basis of profitable pig-feeding. A pig weighing 50 pounds has to take out from the food enough to keep alive that 50 pounds, and the rest can be applied to growth; all that is used up in keeping the animal alive is so much from which the farmer gets no return; when the pig reaches a live weight of 200 pounds, it has four times as much of live matter to keep alive and takes out just so much more from his rations before he uses the remainder for growth.

The changes in the nutritive ratio were not so abrupt as might be thought from what was just said, but the ratios changed gradually from 1 :2 to 1 :4.25, as is shown in the following table:

DAILY RATIONS OF PIGS.

BERKSHIRES.

Period.	Date.	Skimmilk. qts.	Corn Meal. oz.	Wheat Bran. oz.	Nutritive Ratio.
I	May 14–19	2.25	....		1 :1.93
	May 19–26	3	....		
	May 26–July 9	4.50	....		
II	July 9–18	6	12	4	1 :2.88
	July 18–20	6	14	8	
	July 20–30	6	6	18	
	July 30–Aug. 12	6	10	22	
III	Aug. 12–24	6	16	20	1 :3.76
	Aug. 24–Sept. 4	6	24	24	
	Sept. 4–23	6	40	20	
IV	Sept. 23–Nov. 11	6	48	24	1 :4.41

CHESTER WHITES.*

Period.	Date.	Skimmilk. qts.	Corn Meal. oz.	Wheat Bran. oz.	Nutritive Ratio.
I	May 14–19	2.25	....		1 :1.93
	May 19–21	3	....		
	May 21–26	4.50	....		
	May 26–July 9	6	....		
II	July 9–18	6	12	8	1 :3.15
	July 18–20	6	16	12	
	July 20–30	6	16	20	
	July 30–Aug. 12	6	16	26	
III	Aug. 12–24	6	20	26	1 :4.08
	Aug. 24–Sept. 4	6	40	20	
	Sept. 4–23	6	48	24	
IV	Sept. 23–Oct 17.	6	54	28	1 :4.57

YORKSHIRES.

I	May 14–19	2.25	....		1 :1.93
	May 19–26	3	....		
	May 26–July 9	4.50	....		
II	July 9–21	6	12	4	1 :2.76
	July 21–30	6	4	16	
	July 30–Aug. 12	6	10	14	
III	Aug. 12–24	6	10	22	1 :3.59
	Aug. 24–Sept. 4	6	20	22	
	Sept. 4–23	6	30	22	
IV	Sept. 23–Nov. 11	6	40	20	1 :4.17

*The above rations were fed to Chester White No. I; Chester White No. II. received practically the same until Sept. 23, when it was taken sick and was withdrawn from the test.

The Chester White pigs were the heaviest at the start and they more than held their own throughout all the test. The gain in live weight of each pig, during each period, is shown below.

GAIN IN LIVE WEIGHT BY PERIODS.

Period.	Berkshire No. I			Berkshire No. II		
	Live weight at beginning of period.	Live weight at end of period.	Gain in live weight during period.	Live weight at beginning of period.	Live weight at end of Period.	Gain in live weight during period.
I	15	63	48	14½	50	35½
II	63	100	37	50	82½	32½
III	100	156	56	82½	141	58½
IV	156	220	64	141	203	62
	Chester White No. I			**Chester White No. II**		
I	27½	80	52½	27½	68	40½
II	80	121	41	68	104	36
III	121	190	69	104	172	68
IV	190	233	43			
	Yorkshire No. I			**Yorkshire No. II**		
I	20	60½	40½	18	51	33
II	60½	91½	31	51	79	28
III	91½	144	52½	79	125	46
IV	144	208	64	125	175	50

Taking the average of the two pigs of each breed, the following is obtained as the gain per breed per period.

Period.	Berkshire.	Chester White.	Yorkshire.
	lbs.	lbs.	lbs.
I	41.75	46.5	36.75
II	34.75	38.5	29.50
III	57.25	68.5	49.25
IV	63	43	57

It will be noticed that the Chester White made the most gain until the last period. The loss here is apparent, not real, since the smaller gain is due to the fact that the pigs were killed before the end of the period, and so had not so many days of growth as the others. This appears more clearly in the next table giving gain of live weight per day for each pig.

AVERAGE GAIN IN LIVE WEIGHT PER DAY IN EACH PERIOD.

Period.	Berkshire		Chester White.		Yorkshire.	
	I	II	I	II	I	II
I	0.86	0.63	0.94	0.72	0.72	0.59
II	1.15	1.02	1.28	1.13	0.97	0.88
III	1.27	1.33	1.57	1.54	1.19	1.05
IV	1.31	1.27	1.79	....	1.31	1.02

Averaging the pigs of each breed as before, the following table is obtained, showing:—

AVERAGE GAIN IN LIVE WEIGHT PER DAY FOR EACH BREED.

Period.	Berkshire.	Chester White.	Yorkshire.
I	0.745	0.83	0.655
I	1.085	1.205	0.925
III	1.30	1.555	1.12
IV	1.29	1.79	1.165

This shows that the Chester Whites grew faster on the average than either of the other breeds, which as compared with each other are little different.

At the end of the test the account stands with each breed as follows:

Berkshire—Total gain (in 362 days of pig life).....393.5 lbs.
Average gain per day per pig..... 1.09 "
Chester White—Total gain (in 288 days of pig life)....350.0 "
Average gain per day per pig..... 1.22 "
Yorkshire—Total gain (in 362 days of pig life).....345.0 "
Average gain per day per pig..... 0.96 "
Total gain of the six pigs (equivalent to 1012 days of pig life).....1088.5 "
Average gain per day per pig..... 1.08 "

The Chester Whites, therefore, gained in live weight one-fourth faster than the Yorkshires and one-seventh faster than the Berkshires; the Berkshires gained one-ninth faster than the York-

shires. This does not necessarily imply that the Chester Whites are the more economical pigs for raising. They not only grew faster, but they ate more, and it will be seen, when the feed of each breed is studied, that this extra amount eaten partly balanced the extra gain.

If pigs are well kept they should gain faster the older they grow. This was the case with these pigs.

Period.	Average gain in live weight per day for all six pigs.
I	0.75
II	1.07
III	1.33
IV	1.42

This must not be taken to show that pigs are more profitable the older they grow; the opposite is the truth. They do grow faster, but they eat so much larger rations that the extra gain is more than offset by the extra cost. This is shown in the tables of feed which follow:

FEED EATEN PER PERIOD.

	Berkshire No. I			Berkshire No. II		
Period.	Skim Milk, qts.	Corn Meal, lbs.	Bran, lbs.	Skim Milk, qts.	Corn Meal, lbs.	Bran. lbs.
I	229.5	.....	.....	229.5	.....	.....
II	192	18.8	28.5	192	18.8	28.5
III	264	77.3	58	264	77.3	58
IV	294	147	73.5	294	147	73.5
	Chester White No. I			Chester White No. II		
I	304	.....	.....	304	.....	.....
II	192	28.8	35.1	192	28.8	32.9
III	264	101.5	65	264	101.5	65
IV	144	81	42	.....	.....	.....
	Yorkshire No. I			Yorkshire No. II		
I	229.5	.....	.....	229.5	.....	.....
II	192	17.4	21.4	192	17.4	21.4
III	264	58.1	59.5	264	58.1	59.5
IV	294	122.5	61.3	294	122.5	61.3

TOTAL AMOUNT OF FEED CONSUMED.

	Skimmilk, qts.	Corn meal, lbs.	Bran, lbs.
Berkshire, No. I.....	979.5	243.1	160.
Berkshire, No. II.....	979.5	243.1	160.
Chester White, No. I.....	904.	211.3	142.1
Chester White, No. II.....	760.	130.3	97.9
Yorkshire, No. I.....	979.5	198	142.2
Yorkshire, No. II.....	979.5	198	142.2
Total.....	5582.	1223.8	844.4

Having now the pounds of gain made by each pig and each breed, and the amount of food consumed to produce this gain, we can find, by combining, the amount of food required for each pound of gain. This has been reduced to pounds of dry matter, since the water in the food has no feeding value, and since otherwise it would not be possible to combine such different foods as milk and grain.

POUNDS OF DRY MATTER IN FOOD REQUIRED TO PRODUCE ONE POUND OF GAIN IN LIVE WEIGHT.

Period.	Berkshire No. I.	Berkshire No. II.	Chester White No. I.	Chester White No. II.	Yorkshire No. I	Yorkshire No. II.
I	1.05	1.42	1.27	1.65	1.25	1.53
II	2.26	2.35	2.39	2.67	2.46	2.72
III	3.15	3.02	2.95	3.00	3.07	3.50
IV	4.18	4.32	3.24	....	3.52	4.51

AVERAGE OF THE SAME PER BREED.

Period.	Berkshire.	Chester White.	Yorkshire.	Average.
I	1.24	1.46	1.39	1.34
II	2.31	2.53	2.59	2.50
III	3.09	2.98	3.29	3.09
IV	4.25	3.24	4.00	3.91

SUMMARY.

	Total Dry Matter Fed. lbs.	Total gain in Live Weight. lbs.	Pounds of Dry Matter to one pound gain in live weight.
Berkshire....	1,137	393.5	2.88
Chester White	875	350	2.50
Yorkshire....	1,026	345	2.97
Total.....	3,038	1,088.5	2.79

This shows that the Chester Whites grew the fastest and the most economically, though the difference in their favor is not great, amounting to one-seventh the average of the other two breeds; that is, the feed that produced seven pounds of gain of live weight in the Berkshires and Yorkshires, produced eight pounds of gain when consumed by the Chester Whites. The comparison of gain in weight to feed consumed leaves the relative positions of the Yorkshires and Berkshires unchanged. The Berkshires gained the faster and produced this gain on a less amount of dry matter per pound than the Yorkshires The difference between these two breeds amounts, however, to but one thirty-second of the total feed consumed.

COST OF FEED.

The corn meal used was bought at $18 per ton, and $16 per ton was paid for the bran. The skim milk was from our own dairy, and has been considered worth 15 cents per hundred pounds or 1⅓ cents per gallon. These prices were used in calculating the cost of the feed consumed by the pigs.

COST IN CENTS OF FEED CONSUMED FOR EACH POUND GAIN IN LIVE WEIGHT.

	Berkshire.		Chester White		Yorkshire.	
Period.	I	II	I	II	I	II
I	1.58	2.13	1.91	2.47	1.87	2.29
II	2.78	3.17	2.86	3.22	3.10	3.42
III	3.62	3.47	3.33	3.39	3.56	4.07
IV	4.50	4.65	3.58	....	4.00	5.12
Average.	3.27	3.55	2.93	3.10	3.28	3.92

SAME BY BREEDS.

Period.	Berkshire.	Chester White	Yorkshire.
I	1.86	2.19	2.08
II	2.98	3.04	3.26
III	3.55	3.36	3.82
IV	4.58	3.58	4.56
Average.	3.41	3.00	3.57

By the final test of cost the Chester Whites have shown the best financial results. The slight difference between the Berkshires and the Yorkshires is less real than apparent. By reference to the record of each pig separately, it will be seen that the better pig of each of these breeds produced the same results, the feed consumed by Berkshire No I costing 3.27 cents for each pound gain in live weight, and for Yorkshire No. I, 3.28 cents.

The most important lesson to be learned from these tests is that the costs of producing a pound of gain in live weight increases very rapidly as the pigs grow older. This is shown plainly in the following table:

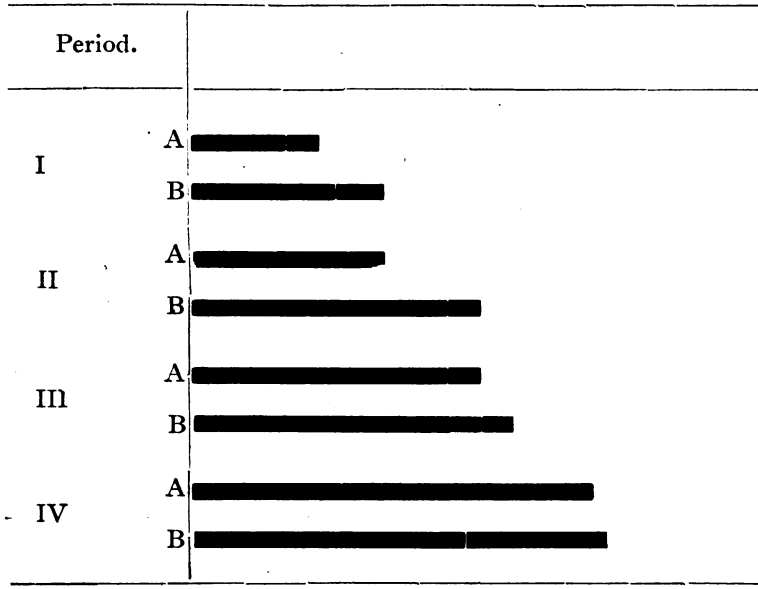
COST OF GAIN, COMPARED WITH LIVE WEIGHT.

Period.	Average weight at the end of the period. lbs.	Average amount of dry matter in food consumed for each pound increase in live weight. lbs.	Average cost of feed consumed for each pound increase in live weight. cents.
I	62	1.34	2.01
II	96	2.50	3.07
III	155	3.09	3.54
IV	208	3.91	4.38

RELATION OF WEIGHT AND FEED.

This can be indicated to the eye in the form below, in which the line A represents the average weight of the pigs at the end of

each period (one inch of length being equal to 100 pounds weight), and the line B represents the cost of the feed that was eaten by the pigs during that period for each pound of grain in live weight (one inch in length representing 2 cents value of food). It will be noticed that as the lines indicating weight increase in length, showing that the pigs were becoming heavier, the lines representing cost of a pound of gain also grow longer, showing that the larger the pig, the more it costs to make a pound of pork and the less profitable the pig becomes.



Out of the food given to the pig, the animal first takes enough to support life, and the surplus, if any, goes to form growth. The more pounds the pig weighs, the more food is required to support life. In the last period there were more than three times as many pounds of live pig to be nourished as in the first period, and consequently a much smaller proportion of the food left for the production of growth. The question naturally arises, then, as to how long the pig can be kept before the cost of keeping him alive will be equal to the value of the increase in live weight and the animal cease to give a profit to its owner. This will depend somewhat on the market price of pork. If pork is high it will be profitable to keep the pigs longer and grow them to a greater weight than if the price of pork is low. This question can be answered for the pigs now under discussion, for we have all the data bearing on the subject. They were sold at 5¼c per pound dressed weight. This is lower than the average price through the year, and if they have paid a profit at this price, farmers generally ought to find pig-raising profitable.

FINANCIAL SUMMARY.

Breed.	Live weight.	Dressed Weight.	Per cent. of shrinkage in dressing.	Selling price per pound of live weight in cents.	Pounds of live weight gained gained during the test.	Selling price of live weight during test.	Cost of feed consumed.	Gain.
Berkshire No. I...	220	183	17	4.36	205.0	$8.94	$6.70	$2.24
Berkshire No. II..	203	168	17	4.36	188.5	8.22	6.70	1.52
Chester White No. I	233	186	20	4.20	205.5	8.63	6.02	2.61
Chester W. No. II	172	139	19	4.25	144.5	6.14	4.48	1.66
Yorkshire No. I...	208	175	16	4.41	188.0	8.29	6.16	2.13
Yorkshire No. II..	175	145	17	4.36	157.0	6.85	6.16	0.69
Total.....	1211	996	18	4.32	1088.5	47.07	36.22	10.85

This shows that the pigs as a whole yielded a profit, but if this profit is analyzed by periods it will be found that most of it was made in the early periods.

NET GAIN PER POUND BY PERIODS.

Period.	Average weight at the end of the period.	Average cost of feed consumed to each pound increase in live weight.	Average selling price per pound live weight.	Average gain per pound increase in live weight.	Total gain during period.
	lbs.	cts.	cts.	cts.	
I	62	2.01	4.32	2.31	$5.77
II	96	3.07	4.32	1.25	2.55
III	155	3.54	4.32	0.78	2.76
IV	208	4.38	4.32	0.06*	0.19*

*Loss.

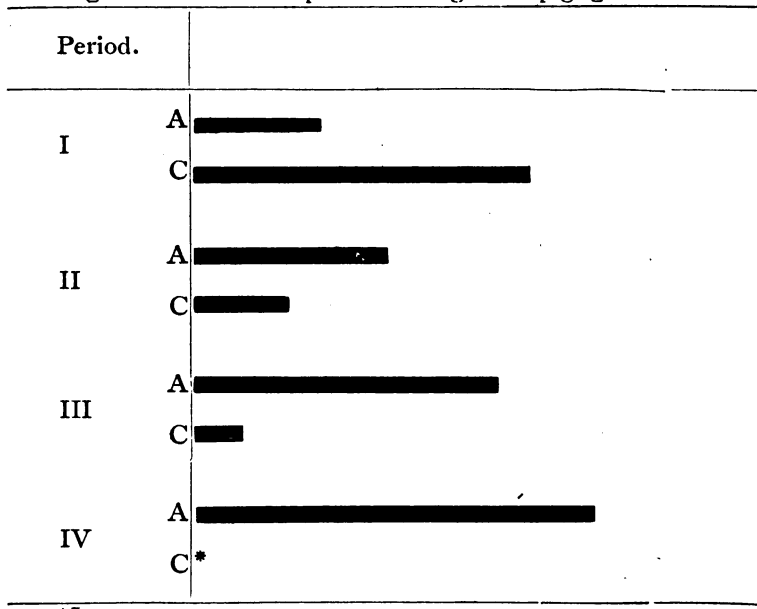
RESULT OBTAINED FROM FEEDING 100 POUNDS DRY MATTER PER PERIOD.

Period.	Pounds gain in live weight.	Excess of selling price over cost of feed.
I	75	$1.73
II	40	0.50
III	32	0.25
IV	26	0.02*

*Loss.

RELATION OF WEIGHT AND PROFIT.

The same thing may be shown in diagram by supposing the line A to represent the average weight of the pig at the end of the period (one inch = 100 pounds weight) and the line C to represent the amount of profit that was obtained for each 100 pounds of dry matter fed during the period, (one inch represents $1.00 of profit). This line C grows shorter as the line A grows longer, showing that there is less profit the larger the pigs grow.



*Loss.

The answer is here shown to the question as to the most profitable time to market pigs. At an average live weight of 155 pounds, the pigs were still yielding a profit above the cost of their feed. This profit had ceased when they weighed 208 pounds. It can be said then that the experiment shows conclusively that in the case of these pigs, under the best of care, there was no profit in keeping them after they weighed 200 pounds apiece, and it would have been more profitable to sell them at about 175 to 180 pounds weight and feed what they consumed during the last weeks of their life to younger pigs.

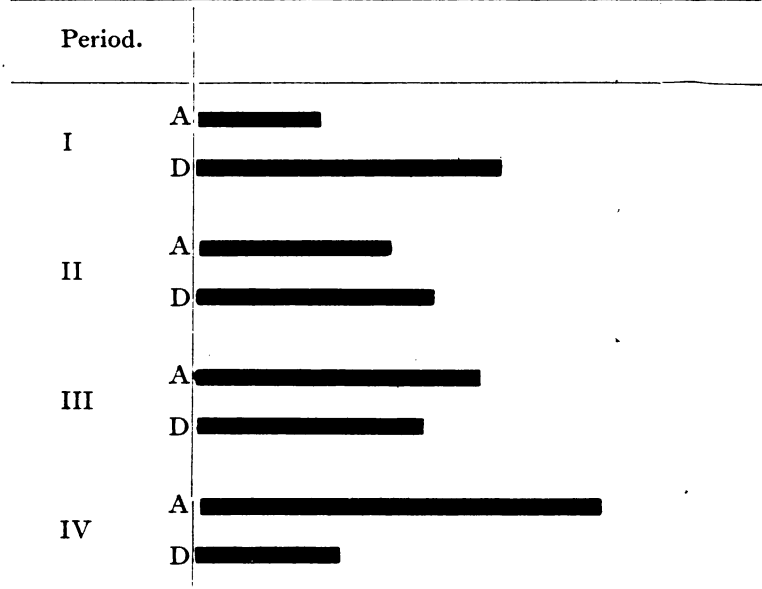
VALUE OF SKIMMILK.

The price of 15c. per 100 pounds has been assigned to skimmilk. It will be interesting to calculate its value in another way. If we suppose the manure to offset the care, and subtract from the amount received for the pork the amount paid for the grain fed, the remainder may be considered the amount realized for the skimmilk.

Period.	Amount realized from skimmilk per 100 pounds per period.
I	32c
II	25
III	23
IV	14
Average.	24c

RELATION OF WEIGHT AND VALUE OF SKIMMILK.

The relation of the weight of the animals to the profit obtained from feeding skimmilk during the different periods is diagrammed below, in which A is the weight of the pig, and D is the amount received for each 100 pounds of skimmilk fed to the pigs during the period. As the lines indicating weight increase in length the lines D representing profit decrease, showing that it is more profitable to feed skimmilk to young pigs than to those of a larger weight.



FERTILIZING VALUE OF FEED.

So far no attention has been given to the fertilizing value of the food consumed. This is an important item in all stock-feeding and with many farmers is one of the principal reasons why stock is kept. The assumption is made in the following calculations that twenty per cent. of the fertilizing ingredients of the food, nitrogen, phosphoric acid and potash, are taken out by the pig for the production of growth, and that the rest is saved without loss by the farmer. Nitrogen is valued at 17 cents per lb., phosphoric acid at 6 cents, and potash at 4¼ cents. These prices are twenty-five per cent. lower than the ingredients cost in commercial fertilizers in Vermont, and this may be considered to just balance the loss of fertilizing matter in feeding.

COMPOSITION OF FEED IN POUNDS PER TON.

	Nitrogen	Phosphoric Acid.	Potash.	Valuation.
Skimmilk.....	11.0	4.1	4.2	$ 2.29
Corn meal.....	29.0	12.8	8.0	6.04
Wheat Bran....	49.7	60.7	31.3	13.42

FERTILIZING INGREDIENTS IN FOOD CONSUMED.

	Berkshire No. I.	Berkshire No. II.	Chester White No. I.	Chester White No. II.	Yorkshire No. I.	Yorkshire No. II.
Nitrogen, lbs.....	18.62	18.62	16.80	12.99	17.52	17.52
Phosphoric Acid, lbs.	10.53	10.53	9.42	7.11	9.90	9.90
Potash, lbs.....	8.01	8.01	7.20	5.60	7.56	7.56
Valuation.....	$4.14	$4.14	$3.73	$2.87	$3.89	$3.89

Total fertilizing value of feed $22.66.

This value should be subtracted from the cost of feed eaten to get the net cost of raising the pork.

Gross cost of feed consumed per pound increase in live weight..... 3.33c.
Value of fertilizing ingredients in food..... 2.08"
Net cost of pork per pound live weight.....1.25"

Gross cost per pound of dressed weight.....4.06c.
Fertilizing value of food.....2.54"
Net cost of pork per pound dressed weight.....1.52"

In the preceding calculations no attention has been paid to the cost of the pigs or what they weighed when they arrived at the Station. They cost $14.00 and they weighed one hundred and twenty-two and a half pounds, which at 4.32 cents a pound would amount to $5.29, and subtracting this from $14.00 leaves $8.71 to be taken from the $10.85. This should be counted as the profit if one is going into the complete financial history of the experiment, but it would not be fair to say that the total profits of the experiment were $2.14 when this is what remains after valuing the skimmilk at fifteen cents a hundred and making no account of the fertilizing value. It also comes from counting the first cost of the pigs as $14.00 and most farmers can raise them for considerable less than that. But all this figuring is aside from the main object of the experiment, which was to find out the most profitable age at which to market the pigs, and that the experiment shows very plainly. The pigs when they reached two hundred pounds live weight were eating more food each day than the value of their daily increase in live weight, that is, they were being fed at a loss. When

they weighed one hundred and fifty pounds they were still making a profit. Somewhere between a hundred and fifty and two hundred pounds live weight was the most profitable time for killing the pigs. The account just about balances at a hundred and eighty pounds, which then would be the most profitable weight for marketing pigs when raised under the conditions of this test. It should be understood that although these pigs consumed less weight of food per day than most farmers are in the habit of giving, yet they were fed all they would eat. It may be added that there is an almost unlimited market for the pork produced from pigs fed in this manner and at prices from a cent to a cent and a half a pound above market quotations.

INDEX.

PAGE.
Act Establishing Vermont Board of Agriculture..... 6
Addison Co., Farming in, by C. P. Smith, (Addison Inst.)..... 133
Addison Institute.....11, 133, 140, 160
Agriculture, Members of Board of..... 3
Agriculture, The New, by J. W. Newton, (Stowe Inst.)..... 150
Aitken, Geo., Stock Breeding, (Woodstock Inst.)..... 166
Alburgh Institute..... 11
Analysis of Licensed Fertilizers.....362 to 371
Aphis, Elm Leaf, (Figs. 61, 62, 63, 64)..... 267
Arsenites as Insecticides..... 200
Beetles..... 245
Bennington Institute.....17, 27, 46, 78, 88, 98
Benson Institute.....18, 30, 47, 75, 113
Berlin Institute.....13, 48, 69, 71, 75
Bi-Sulphide of Carbon as an Insecticide..... 203
Bliss, D. W., Centennial of Justin Morgan, (Royalton Inst.)..... 120
Bloomfield Institute.....30, 48
Board of Agriculture, Members of..... 3
Board of Agriculture, Resolutions relating to duties of..... 7
Bordeaux Mixture as an Insecticide and Fungicide..... 208
Bradford Institute..... 74
Brandon Institute.....32, 101
Brattleboro Institute..... 41
Brookfield Institute.....14, 20, 32, 41, 101
Butter Making, Perfect, by W. W. Cooke.....17, 337
Canker Worms..... 239
Carbolic Acid as an Insecticide..... 203
Cecropia Moth..... 231
Centennial of Justin Morgan, by D. W. Bliss, (Royalton Inst.)..... 120
Chapin, Wm., Grass..... 296
Chapin, Wm., Removing Obstacles..... 301
Chapin, Wm., Vermont Farmers and Farms..... 283
Coxcomb Gall Louse, (Fig. 66)..... 278
Coleoptera..... 245
Contents, Table of..... 2
Cooke, W. W., Commercial Fertilizers..... 351
Cooke, W. W., Perfect Butter Making..... 337
Cooke, W. W., Wastes of the Dairy..... 373
Copperas as an Insecticide..... 204
Corn Crops..... 30
Corn Fodder and Ensilage, by H. W. Vail.....27, 315
Coventry Institute.....42, 49, 68, 80
Crops..... 41
Dairy Stock, Breeding of..... 13

Dairy, Wastes of the, by W. W. Cooke 373
Dairying in Vermont, by R. C. Smith 46, 325
Davis, M. W., Gilt Edge Butter 310
Devon Cattle, Origin of, by M. A. Preston, (Royalton Inst.) 155
Dorset Institute 33, 50, 80, 103
East Fairfield Institute 50, 80
Elm Bark Louse 266
Elm Borer, (Figs. 52, 53) 254
Elm Leaf Beetle, (Fig. 48) 248
Elm Leaf Crumpler, (Fig. 65) 273
Enemies of Injurious Insects, Insect 189, 198
Enosburgh Falls Institute 11
Ensilage and Corn Fodder, by H. W. Vail 27, 315
Fall Canker Worm, (Figs. 44, 45) 242
Fall Web Worm, (Figs. 25, 26) 221
Farm, The 98
Farmers and Farms, Vermont, by Wm. Chapin 283
Farming in Addison County, by C. P. Smith, (Addison Inst.) 133
Farms of Vermont, M. O. Howe, (Farmers' Course) 183
Farmers' Wives, Talk with, by Mrs. A. J. Gibbs, (Benson Inst.) 113
Feeding Farm Stock 68
Feeding Experiments with Pigs at Vermont Experiment Station 382
Fertilizer Law, Vermont State 8
Fertilizers, Analysis and Valuations of ..... 362 to 371
Fertilizers, Commercial, by W. W. Cooke 351
Fertilization 69
Forestry 71
Former Members State Board of Agriculture 4
Franklin Institute 20, 33, 53, 90, 103, 145
Fruits and Vegetables 71
Gibbs, Mrs. A. J., Talk with Farmers' Wives, (Benson Inst.) 113
Gilt Edge Butter, by M. W. Davis 310
Glover Institute 23, 34, 55, 68, 91, 104
Goodale, R. C., General Information, (Addison Inst.) 160
Grand Isle Institute 22, 56, 73, 76, 82
Grapevine Flea Beetle, (Fig. 46) 245
Grass, by Wm. Chapin 74, 296
Handling of Milk 17
Hardwick Institute 35, 58
Hellebore as an Insecticide 204
Hemiptera 259
"Honey Dew," Source of 260
Horses, Vermont, by C. M. Winslow 80, 333
Howe, M. O., the Farms of Vermont, (Farmers' Course) 183
Hydrocyanic Acid Gas as an Insecticide 206
Imported Elm Leaf Beetle (Figs. 61, 62, 63, 64) 267
Injurious Insects, by G. H. Perkins 189
Insect Enemies of Injurious Insects 189
Insects Injurious to the American Elm 207
Insecticides 199
Institutes 11, 13
Johnson Institute 58, 84
June Bug (Fig. 47) 246
Justin Morgan, Centennial of, by D. W. Bliss (Royalton Institute) 120
Kerosene Emulsion as an Insecticide 201
Lace Wing Fly (Fig 5) 261
Lady Birds, (Figs 57, 58, 59) 261
Law Relating to Sale of Fertilizers in Vermont 8
Lice, Plant 259
Maple Sugar 84
May Beetle (Fig. 47) 246

Members of State Board of Agriculture..... 3
Middlebury Institute..... 91
Milk, Handling of..... 17
Milton Institute.....43, 59
Mourning Cloak Butterfly, (Figs 23, 24)..... 219
Mutton Sheep and Stock Raising, by B. W. Smith, (Addison Inst.)... 140
Newport Institute..... 87
Newton, J. W., The New Agriculture, (Stowe Inst.)..... 150
Norwich Institute.....61, 69, 70
Obstacles in Farming, Removing, by Wm. Chapin.....110, 301
Origin of Devon Cattle, by M. A. Preston, (Royalton Inst.)..... 155
Orthoptera..... 259
Perkins, G. H., Injurious Insects..... 189
Pig Feeding 86, 382
Pigeon Fremex, Horntail, (Figs 20, 21)..... 215
Pittsford Institute..... 11
Plainfield Institute.....23, 60, 86
Plant Lice..... 259
Polyphemus Moth. 230
Pomfret Institute.....24, 105
Potatoes..... 87
Poultry Keeping Profitable, How to Make, G. W. Twitchell, (Farmers' Course..... 169
Preston, M. A., Origin of Devon Cattle, (Royalton Inst.)..... 155
Pyretheum as an Insecticide..... 202
Randolph Ceutre Institute..... 62
Red Shouldered Sinoxylon (Figs. 49, 50)..... 253
Report of the Secretary of Board of Agriculture..... 11
Robber Fly, (Fig. 3)..... 191
Rose Bug, (Figs 57, 58, 59)..... 261
Royalton Institute..... 15, 64, 77, 83, 86, 120, 155
Saw Fly, Elm, (Fig. 19)..... 213
Secretary's Report..... 4
Sheep..... 88
Sheep and Stock Raising, by B. W. Smith, (Addison Inst.)..... 140
Soldier Bug, (Figs 1, 9, 10)..... 191
Smith, B. W., Mutton Sheep and Stock Raising, (Addison Inst.).... 140
Smith, C. R., Farming in Addison County, (Addison Inst.)..... 133
Smith, R. C., Dairying in Vermont,..... 325
Spring Canker Worm, (Figs. 41, 42, 43)..... 239
Spring Soldier Beetle, (Fig. 2)..... 191
Starvation for Insect Extermination 205
St. Johnsbury Institute..... 36
Stock Breeding..... 13
Stock Breeding, by Geo. Aitken, (Woodstock Inst.)..... 166
Stock Raising, Mutton Sheep and, by B. W. Smith, (Addison Inst.) . 140
Stowe Institute.....16, 25, 37, 107, 150
Summer or Winter Dairying 46
Table of Contents..... 2
Tachina Fly (Fig. 16)..... 197
Tiger Beetle (Fig. 4, 5, 6, 7, 8) 191
Towle, E. R., Plain Thoughts for Everyday Farmers, (Franklin Inst.) 145
Tree Cricket, (Fig. 55)..... 209
Tussock Moth, (Figs. 29, 30, 31, 32)..... 225
Twitchell, G. M., How to Make Poultry Keeping Profitable (Farmers' course).. 169
Underhill Institute..... 47
Vail, H. W., Corn Fodder and Ensilage 315
Vegetables and Fruits..... 71
Vermont Farmers and Farms, by Wm. Chapin..... 283
Vermont Horses, by C. M. Winslow..... 333

Wastes of the Dairy, by W. W. Cooke. 373
Wastes of the Farm. 111
Water as an Insecticide. 205
Waterbury Institute. 11
West Concord Institute. 71, 83, 85, 108
Westminster Institute. 25, 38, 65, 85, 94, 109
Winslow, C. M., Vermont Horses.. 333
Winter or Summer Dairying. 46
Woodstock Institute. 16, 77, 84, 97, 111, 166